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POTATO CULTURE.

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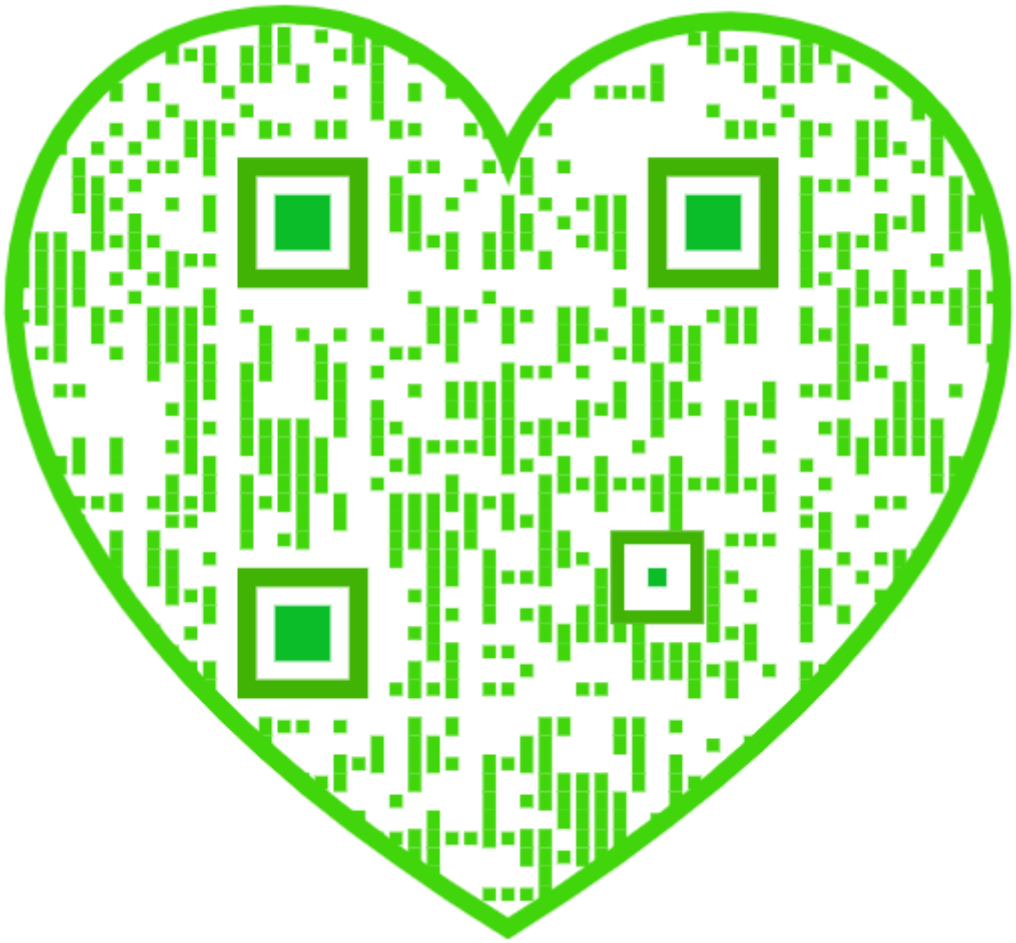

THE A B C

OF

POTATO CULTURE.

How to grow them in the largest quantity, and of the finest quality, with the least expenditure of time and labor; carefully considering all the latest improvements in this branch of agriculture up to the present date.

FULLY ILLUSTRATED.

BY T. B. TERRY, HUDSON, OHIO.

Second Edition; Revised, and Largely Re-written.

A. I. ROOT,
MEDINA, OHIO.
1893.

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Publisher's Preface to First Edition.

Dear friends, one great reason why I have asked Mr. Terry to write this book on potatoes is the number of people that are at this present time begging for something to do. In our factory for the manufacture of bee-supplies, we employ from 100 to 150 hands, and it is not only daily but sometimes hourly that I am besieged with applications for something to do. I have employed as many as I could, and suggested means of employment to those I have been obliged to send away. Many times these friends say they have been everywhere, asking for employment. This matter has been on my mind for many months, and it has seemed that the great problem before our American people was to find something they *could* do, to earn the necessaries of life. Work in factories is, to a certain extent, not permanent. The vicissitudes of business necessitate cutting down the force, and sometimes stopping entirely. What shall the men and women of America busy themselves with? How shall they earn their bread by the sweat of their face? After having considered this question prayerfully, the answer has come to me, "Go out into the open fields, and ask old Dame Nature for something to do—till the soil, busy yourself with domestic animals, bees, poultry, and the like." After you have once learned to do this, you are independent; that is, you are not dependent on any human being for the wherewith to earn your bread. You are looking to God the Father; and he has said, "Him that cometh unto me, I will in no wise cast out." Neither myself nor friend Terry would advise everybody to go to raising potatoes; but a great many are so situated that they could, by this means, supply themselves with this great food staple. A penny saved is a penny earned, you know, and brother Terry tells you not only how to raise potatoes without any very great expense of time and labor, but he also tells you how to raise better potatoes than you are likely to buy of anybody. Again, a great many are already raising potatoes; and if you want to know how they raise them, go around about digging-time.

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I remember of working, when a boy, for a neighboring farmer. His good wife must have something for dinner for the harvest hands; so she went out into the garden, and pushed the weeds to one side, and hunted until she found potato-vines enough to indicate where the potatoes had been planted. After working among the weeds hard enough to have earned a panful of good potatoes provided she had reasonable pay for the hard work she did, she got a few little ones, to help make out a dinner. Poor woman! my heart goes out in sympathy and pity as I think of it now. After having worked hard to raise a large family of children, grim consumption took her away. If I am correct, scarcely one of the large family of boys and girls was content to remain on the farm. My friend, may be your good wife or mother would rejoice to see a nice thrifty patch of fine potatoes. What mother is there who does not rejoice to see her growing boys relish their food, especially after the boys have been at work in the harvest-field? Well, don't you think you would enjoy it to help that good mother by supplying her with an abundance of nice potatoes ready at hand? Did it ever occur to you that it is fun to raise potatoes? Why, my friend, it seems to me there are few enjoyments in the world like seeing potatoes do their level best; and when you have got so well acquainted with the nature of the vegetable, so it is all under your thumb, as it were, what a thrill of pleasure it gives one to be able to make them do their best, and do it every time, whether we have drouth or extremely wet weather! You may say it is impossible; that we are not independent of the weather. My friend, we *are* independent of the weather, to a great extent. If every thing is done as well as it can be toward raising a nice crop of potatoes, we can be pretty sure of a fair crop, even during the worst drouth, or in spite of frost or rain or snow. May be you think I am claiming a good deal. Well, friends, the best way in the world to prove it is to try following the directions given in this book, with a small
tch in the garden (if you don't do any more than that); you
n be ready to extend operations a little until you have a
entv acres, as has friend Terry, every season.
n a large scale to begin with. Prove
prove your knowledge and ability;
when you do walk, you will be able

to go safely and surely. I am especially anxious that the boys of our land shall like this book. The boy who can raise a good crop of potatoes, and do it every time, is entitled to honor and respect. He is a useful member of society, and he is sure of a job anywhere, under any circumstances; for the commodity that he produces will probably be a staple so long as there are hungry people waiting to be fed. His occupation is also an honest one. Somebody has said, that an honest man is the noblest work of God.

May God's blessing go with our little book, and it surely will rest on all who learn to love these rural industries, and who learn to see God through his works.

A. I. ROOT.

Medina, O., April 20, 1893.

Author's Preface to Second Edition.

It is just eight years ago this month since the first edition of this book was printed. In revising it now I am really surprised to see how many things there are that I want to change a little. My experience has come from many seasons' work in the field, and much study. Really, the best of my life has been spent in this line; but still there are some points that I wish I had two or three more years' experience on before writing these pages. Thus it will always be, however; and long before this edition is sold out, readers will find it behind the times on some point, doubtless. There will be little found in these pages that the writer has not given to the public in substance, through the columns of the papers for which he has written, such as *The Country Gentleman*, *Ohio Farmer*, *Practical Farmer*, *Rural New-Yorker*, *National Stockman and Farm Journal*. The object of this book is to get it together into compact, convenient shape for reference, and corrected to date.

Hundreds of people have written me during the past few years to know whether I still thought thus and so, as stated in the old edition of this book. Now, I sincerely hope that all who buy this edition will also take the paper for which I write weekly, *The Practical Farmer*, of Philadelphia; not that it makes a cent's difference to me, but so I can at once let them know about any thing I may wish to change. This will relieve my mind; because, if any point in these pages is found to be wrong, it can be corrected at once. I assure you, friends, that I feel a good deal of responsibility in writing a book like this. Many of you will not realize how much. It may be quite a serious matter if some friend is led astray on but a single point. There was one point in particular in the old edition, about which I wrote in perfect good faith;

and still, during the past three years I would have given $100 if I could have changed it in all books out. I know that some lost money by taking my advice, unless they read the papers closely.

The following pages will be written with all the care possible, and with one desire only—to do the reader some real good. It has been thought best that I write in the first person, as the book is largely a narration of my own experience. If this little work should lead you to think and study more, whatever line you are pursuing; if it should rouse your ambition to try to do your very best; and if this should make you more prosperous and happy, as it certainly will, you don't know how it will please

Your friend,

March, 1893. T. B. TERRY.

CHAPTER I.

Soils and Their Preparation.

The very best soils for potato-raising, perhaps, are those varying between a sandy or gravelly loam and a clay loam, although they can be raised, of course, with more or less profit on lighter ones, on black soils, or almost any kind of land, even on quite heavy soil if tile-drained. But, do not risk them on heavy land that is not underdrained, as you may lose more than the cost of draining in a single year. It may be wise to think twice before deciding to tile-drain your land in order that you may devote it to potato-raising—to think whether it may not be more profitably used, all things considered; but if you have determined to raise potatoes any way, then underdrain thoroughly the first thing you do. "Lock your barn-door *before* your horse is stolen." Hundreds and hundreds of acres of potatoes are destroyed every wet season by stagnant water. Underdraining would have prevented this for the most part. Thirty dollars' worth of tiles and labor to the acre might have saved $50 or even $100 worth of crops. Sometimes a half or even a third of $30 would have done the necessary draining.* Portions of the field were wet, and the farmer could not get on to harrow and kill weeds in season, and perhaps the seed rotted in the wet spots. I have seen just this occur on large fields, and a practical failure come from want of tile-draining on only a part of the land. I have known of cases on land quite similar to my own, where the farmer met with failure for lack

* With friend Terry's permission, I want to suggest, right here, that, before you commence tile-draining, the investment of 40 cents in the little book by W. I. Chamberlain, entitled "Tile Drainage," will enable you to start your work right, and to save both money and labor in doing it. See last pages of this book. A. I. ROOT, Publisher.

of about $15 worth of tile-draining per acre, while my land the same season brought about $100 per acre. The draining in this case would have paid for itself several times over. The most of my land is a loam, but some of it is almost too sandy or gravelly, and some too heavy. The heavy soil we have tile-drained; but still I find that, in a very wet season, potatoes will rot some in spite of the drains. Last season was the worst one we have ever experienced for excess of rain. From the first of May until into July our ground was almost constantly saturated. We happened to have a field in potatoes that has considerable heavy soil in it. We have never lost any thing to speak of from water on it before, since it was drained. Last year there were spots to the amount of an acre, all together, where the seed never came up, put in, as it had to be, with the soil too wet; and the average of the field was, of course, not satisfactory. No water stood on the surface an hour after a rain. The drains did their full duty, but the soil was kept saturated and packed, so potatoes could do little. For once, man was just about powerless. I measured a half-acre on the best of this field, where the stand was good, and dug but 91 bushels. On a measured half-acre in another field, of lighter soil and with natural drainage, conditions of fertility about the same, we dug 157 bushels. There were portions of the first half-acre that yielded as well; but tile-drained clay spots pulled down the average. In a dry season I get good returns where the crop failed this very wet season. On an average I get the most satisfactory crops, all things considered, on soil that is not quite heavy enough to need underdraining to any great extent. Such soils are light enough to work easily; the potatoes come out bright and clean, and still they are heavy enough to be strong soils, and to hold manure well, and clover does very well on them. The farmer who raises only a few potatoes for his own use need not pay such particular attention to the soil, as, if half of them are likely to rot from wet feet, he can plant a larger patch; or if they do

not come out bright and clean, they are for his own use. But the man who raises acres of potatoes for market should grow them where they will come out looking nice, if possible, as that helps to sell them, and he can not afford to plant where there will be much danger from wet-weather rot or seed rotting, or where it will take a very large amount of labor to prepare the soil properly.

I have said considerable about having the right kind of soil, you will notice. To my mind, in this age it is unwise to try to make our land do what it is not best fitted for. I could, I think, take the heaviest clay on my farm and make it good potato land. This is possible, but I think it far wiser to use land for this purpose that is naturally about right, and use the clay for what it is best fitted. Of course, it may pay to change the nature of a garden-patch; but I am speaking of field culture. A friend who has heavy clay land, and keeps a fine Jersey dairy, came here once, and was so impressed with the fact that I was making money out of potatoes that he asked my advice about his going into the business. He was in the habit of growing two or three acres a year. After getting all the particulars, I told him I not only would not grow more potatoes, but I would never again grow even the two or three acres he had been growing; that it was far better for him to extend the butter business, and grow feed for his cows on the heavy land he had. I am sure this advice was sound. Great success in potato culture will be on soil reasonably fitted for the business naturally. The business is changing, and the market is less and less supplied with a few loads from every farm, and more and more from great areas where the business has been gone into on a large scale, under favorable conditions. On unfavorable soils there will be little profit in trying to compete with the last-named growers, except, perhaps, in a small way for home market.

Fall Plowing.

I do not think there is any thing gained by fall-plowing sod land designed for this crop, unless one is troubled by grubs or wireworms; and there is a better way to manage these—not to have them—that I will speak of in the chapter on "Rotation." If the soil is very heavy and lumpy, the frost may pulverize it a little more than it otherwise would, if it is turned up in the fall; but such soils are not profitable ones to plant potatoes on any way, you know. I have found it just about as much work to loosen up and pulverize the soil five or six inches deep, in the spring, where it had been fall-plowed, as it would have been to plow it and pulverize it both in the spring. This, for rather heavy soil. On light soil, one might gain some time in the spring by fall plowing; but there is another serious question to consider, particularly for farmers with light land. In this latitude, with our open winters, and heavy rains of fall and spring, we shall lose more or less fertility by having our land plowed. It leaches downward with the water. In the far North, where the land is locked up by frost most of the time, it will not make so much difference. Farther south it will make more. As a general rule, unless you have some good local reason for doing otherwise, keep something growing on your land just as nearly all the time as possible. This practically prevents loss of fertility. Let the sod stand, with its live roots in the soil, until the ground is dry enough to crumble off the mold-board in the spring; then if you are ready to plant, turn it over and plant at once, and get something else growing. Keep land busy, as well as yourself. Doesn't it need rest? Yes; but a change of work (rotation) is a rest to it, and all it needs. Give it any more, and you lose. If you have a corn-stubble to plant next year with potatoes, sow rye or something to occupy the land till you plow for potatoes. I had a half-acre of stubble land last fall that I wanted to plant this year; and, not having rye, I sowed wheat thickly. I shall have a fine growth to turn under by

the last of April. Some of that fertility I should not have if I had not sown the wheat, and had its live roots constantly on the watch to catch up any stray drop of fertility. When I turn under the wheat it will quickly become plant-food again, for the potatoes to use.

All About Plowing.

A deep soil, deeply plowed. is undoubtedly best for potatoes; but this deepening should be done very gradually, say an inch once in two or three years, until you get your soil as deep as you can turn over with a plow. Drought is one of the greatest enemies of the potato crop; and a deep soil will the best withstand dry weather. Again, potatoes are naturally a deep-feeding crop. We have land we plow 8 inches deep, and some even more than this. The soil we turn is now about twice as deep as when I began farming here 23 years ago, and I feel certain I am working in the right direction. I use an Oliver chilled 40 X walking-plow. In fact, we have two of this size. It is the only plow I could find at the time that did the work to suit me, and to the depth I want. There are plows that will turn a smoother furrow, and lay it over flat and nice; but this isn't what I want. I want lap-furrow plowing, the furrows on edge, and just over a little, so they will not fall back. I do not want the surface of sod turned over flat on to the subsoil, by any means, but scattered through the soil, where the roots will grow. A plow of this kind will not draw as easily as one with a longer and less blunt mold-board; but it does the right kind of work. Of course, there is a jointer on the plow, and a wheel to regulate the depth. These are as necessary to me, almost, as the plow itself. Without the jointer, the grass on the upper edges of my lap furrows would make trouble; as it is, there is only mellow soil there. The jointer, or little plow, attached in front of the large one, cuts a furrow about two inches deep, and throws it into the big furrow, where it is covered by the furrow-slice from the

large plow. The wheel gives uniformity of work all through the field, and slightly decreases the draft. The plow properly set, with a wheel on, on such clean smooth fields as a farmer should have, almost runs itself. The days of "holding" a plow are over. A mere touch now and then should guide it.

In plowing in the spring for potatoes, one should be very careful about tramping ground unnecessarily. Winter frosts have made it loose—just right for potatoes. It is easily packed too solidly when horses tramp on it, as it is usually moist at this season. I got through "plowing around" years ago. We back-furrow in lands; and, if the lot is not too wide, all in one land, so as to have no dead-furrows. It takes a little more time, but we do more perfect work. Take one of our strips, 16x60 rods. Beginning in the center, say ten feet from one end, we go down and back, and so on around, drawing the plow across the ten feet or so at the ends, just plowing lengthwise. When within ten feet of being done on the sides, we plow the ends too, thus finishing up the lot. In the fall we put in wheat without plowing. When it comes around again in the rotation, we start plow ten feet, say, from one end, and plow down one side; stop ten feet from the other end; draw the plow across the end; plow up the other side; draw the plow across the other end, and so on. When done we plow the ten-foot head-lands all one way, one at a time, drawing the plow back. Thus we get land back level, and the horses hardly tramp on it at all after it is turned. I wish I could harrow it with a balloon, so the horses need not tramp it. I can't do this, but can prevent tramping while plowing.*

You will notice that my lap-furrow plowing, with the edges of the furrows up in the air, and the grass shaved off and buried out of the way, is in grand shape for the smooth-

* For a more extended review of the matter of how land should be managed in plowing, see Publisher's Appendix in latter part of this book.

ing-harrow to take hold of. This may help to explain why I can do so well with it (see latter part of this chapter). What would be the sense of turning a furrow over flat and smooth, and then using a cutting-harrow to dig it up again, when one can leave it up loose and save half the harrowing? This is just what we do. These matters will seem very simple to experts; but many are not experts, and this is the A B C of potato culture, you know. I am trying to make every point clear enough to be understood by a beginner. That jointer pays in two or three other ways. Properly set, it puts all sods under, so nothing will harrow up—a small matter, some may think; but sod is plant food; potatoes feed down in the soil; and if sods are on top, the roots can not get them that year. See? Again, bits of sod are in the way of using harrow, weeder, etc. Perhaps you think you know all about as simple a matter as plowing a field, and harrowing it for potatoes. Well, I hope you do; but I fear a good many have not thought of every little thing that may be done to their advantage. Success in the future, sharp as competition is, must come from careful attention to little details.

On my soil I have not found subsoil plowing to pay. I have a plow, and have tried it faithfully. It might do good under some conditions; but I would not advise any one to go into it very largely until he has found by actual experience that it pays. It is possible that, with drainage and clover-growing in regular rotation, my subsoil is in better condition than the average. If so, I believe the other fellows will do well to get the better condition in the same way, without extra cost. Theoretically, subsoil plowing is all right. It ought to pay. I was sure it would. But cold facts have chilled my original ardor. The subsoil plow does not pulverize much. It breaks up the clay roughly. If it were possible to pulverize all the subsoil for ten inches, say, as thoroughly and finely as I can the surface, and do it when reasonably dry, I should like to try it on an acre. I am in-

clined to think that right at this point is where common subsoiling is lacking.

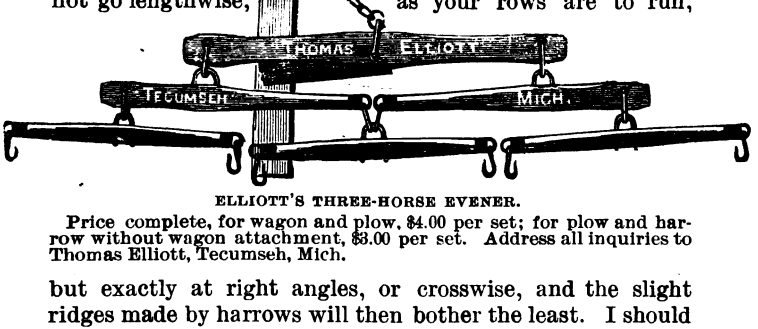
Harrowing.

After the ground is plowed in the spring, work it down moderately fine soon after it is turned over, before it has time to dry out. It will work easier and better then than ever again, particularly if there should be drying winds and no rain. I have got caught this way, haven't you? I have had to wait for a rain, or do a great deal of work to properly prepare a seed-bed. It is not best to work down potato-land, before planting, as fine and firm as you would land for wheat. It is better to do a part of the working and pulverizing after the crop is planted, and before it comes up. You kill two birds with one stone, and you do not get the land packed so solidly. Years ago I used to prepare my soil very thoroughly before planting; then after planting we harrowed, say, three times to keep weeds down; and the result was, ground very solidly packed before the crop came up. This was wrong. Potatoes do best in a fine but loose, light soil. It *must not* be packed as wheat likes to have it. I now prepare land partly before planting and partly after, and keep all weeds down at the same time. There is less tramping and packing of the ground, and still as perfect preparation, and weeds as well kept down.

A favorite way with me to prepare a field for potatoes is to attach three horses abreast to a Thomas smoothing-harrow, which will be described in another chapter; put a plank across the three sections, and get on and ride. This weight sinks the teeth in to the woodwork, usually, and does a large amount of pulverizing at a rapid rate, in going once over the ground, and it pulverizes quite deeply. The harrow takes a sweep of some ten feet. All my potato-ground has been prepared in this way, some years. The work is done soon after plowing, before the ground becomes dry and hard. This is the great point. After the lumps once become dry

and hard, the smoothing-harrow will not have much effect on them—only to move them around a little. It can not do much pulverizing unless you wait for a shower, and go on just as it gets dry enough. The safest plan is, never to let the lumps dry. If it is very drying weather, hitch on to the harrow after dinner, and harrow down what you plowed in the morning, and the next morning work what was plowed in the afternoon. Many friends have wondered how I could harrow land, that was at all heavy, with a smoothing-harrow. They thought it would not touch hard clods. You have here in this chapter the secrets. If a thing must be done any way, why not do it just when and in the way it can be done easiest and best? Some one may ask, "Why pulverize the surface soil? The roots do not grow at the top." Well, there would be danger of cut seed drying up in a dry time, if we did not, and fine soil acts as a mulch to prevent the lower soil from drying out, and, of course, the harrow-teeth go down in so as to fine the soil below some also. Now, after harrowing just this once, we have often rolled the ground and gone on with the planting, and considered that we were doing the best we knew how. If there are hard spots in the field, that the smoothing-harrow will not work down properly, if used on time, or if the entire field is in such shape that more working seems to be needed, we go over it with a cutaway, or disc harrow, crosswise, lapping half, then use the smoothing-harrow again lengthwise, and roll. If there is an unusually hard clay spot, we go over it alternately with cutaway, Thomas, and roller, until it is fine, just working that spot down by itself, when the rest of the field does not need so much tillage. The first time over with the smoothing-harrow, we go the same way we plowed, so as to push the furrows over rather than tear them up. A set of three-horse whiffletrees, for three horses abreast, is a good thing, as you can go right along then, with weight enough on to set the teeth well down. Elliott's three-horse evener is simple, light, and cheap. I have one, and it is just the

thing to harrow and plow with. The disc and cutaway harrows are the best implements we have for working soil more than can be done with a Thomas harrow. They should always be used back and forth, lapping half; as then, with careful driving, the land is not ridged much. We have both, but rather prefer Clark's cutaway to a disc. We think it draws a little easier, and digs deeper on hard ground, and it does not ridge the ground so much. But both are good tools. A cutaway, Thomas, and roller, are all the tools I need to prepare potato-land; and the same tools are now used to prepare the potato stubble for wheat without plowing. Let me advise that, if you use a cutaway or disc in preparing potato-land, you do not go lengthwise, as your rows are to run,



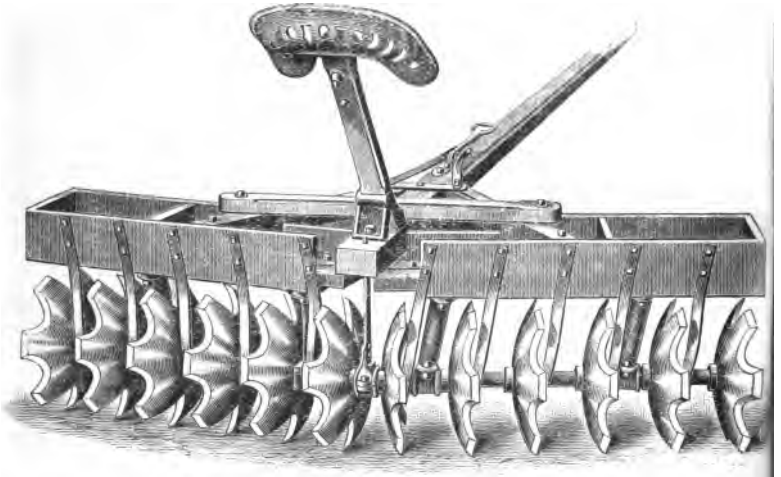
ELLIOTT'S THREE-HORSE EVENER.

Price complete, for wagon and plow, $4.00 per set; for plow and harrow without wagon attachment, $3.00 per set. Address all inquiries to Thomas Elliott, Tecumseh, Mich.

but exactly at right angles, or crosswise, and the slight ridges made by harrows will then bother the least. I should explain, perhaps, that my clover sod, on which no stock ever runs, is very mellow, usually. With less favorable conditions, more harrowing (the use of the cutaway) might always be needed. Again, some years the ground seems much more mellow than others. You get the point of why I do as little tillage as will answer, before planting. But you must not overdo it. Small-cut pieces of seed would dry up if the surface were too coarse. In this chapter you will find cuts of the cutaway harrow and a roller.

If there is danger of rain, do not roll ground any faster

than you can plant, as the harrowed surface will dry off after a rain quicker than the rolled one, and the water will not run, but soak down where it falls, as the potato-grower always wants to make it do. As well as I know this, and as many years as I have practiced it, last year I got caught. My son rolled along just ahead of me, as I planted some five acres; and then, as the weather seemed very settled, I told



CUTAWAY HARROW.

The Cutaway Harrow Co., of Higganum, Ct., write us, under date of April 24, that the retail price of the above harrow is $30.00. If ordered directly from the manufactory, the price will be 10 per cent off on board the cars at their depot.

him we would take the risk and roll around the rest of the piece, and have it ready. Very soon the wet weather set in, and I lost some money by not following the plan that I knew was safest. Do not plant until your soil is in just the right condition, or until you can see your way clear to make it just right before the crop comes up. Thorough tillage pays.

Mr. C. A. Kellogg, of Geauga Co., Ohio, writes me that he

put in a part of his potato crop one year thoroughly well, and a part of it, for lack of help, not quite as well, and he says he can see now, after digging, that, if he had paid $5.00 or even $10.00 a day for help to put in all his crop as well as he did a part of it, he would have been the gainer. This statement, coming from a farmer who raised 650 bushels of potatoes from 9 bushels of seed, is worth remembering. Large p ying crops rarely come without a good deal of work.

DUNHAM'S STEEL LAND-ROLLER NO. 2.

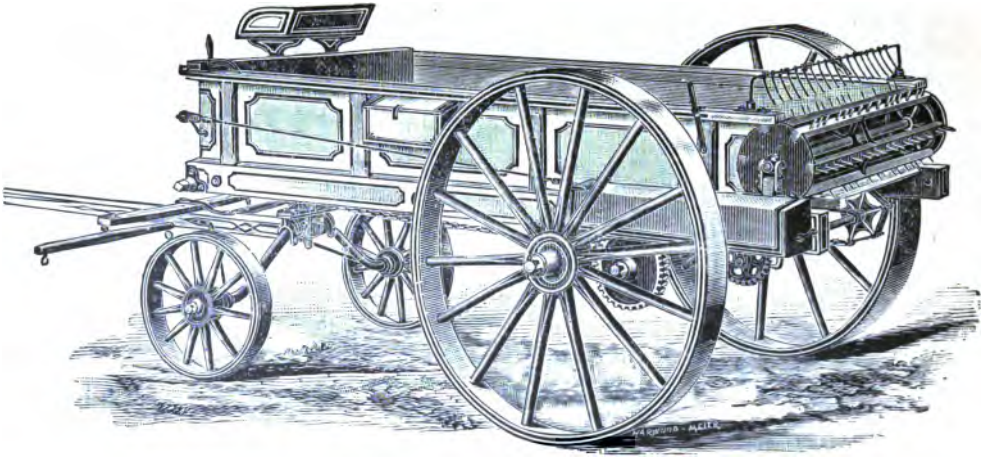
The price of the above implement is $30.00. All correspondence should be addressed to J. W. Dunham & Son, Berea, Ohio.

My friend could have got all the help he wanted, no doubt, for $1.50 a day, and the difference between that sum and $5.00 or $10.00 represents the profit he would have made by doing the best he knew how. The extra labor required, if properly managed, does not eat up the extra crop, by any means.

CHAPTER II.

Manures and Their Application.

If wanting to apply manure for the direct use of the potato crop, I would leave my year's manure over until fall, and then along in September or October, when most convenient, I would draw it out and spread evenly on the surface of sod ground that was to be plowed the next spring for potatoes. First, if following this plan, care must be taken that the manure does not waste while being kept over. If it heats much you lose ammonia; if much rain falls on it, the more soluble parts leach out. Cement floors in the stables, and my covered barnyard, and manure spread evenly over the yard, and tramped, and some land-plaster sprinkled on the surface occasionally, will keep it perfectly for any length of time. Without a roof over the yard you may pile it away from the eaves and surface wash, mix the different kinds together, encourage stock to tramp it by putting up rubbing-posts on the pile, thus preventing excessive heating and waste; cover lightly with earth in the spring, and have a pile in very good shape for fall use, without much trouble or loss. I went to the trouble of drawing a large pile, thus kept, out in the spring, and composting it with muck in alternate layers, for several years. I did not get my pay for the extra handling, to the best of my belief. The manure spread on the sod any time in the fall will suffer no loss. It will not be likely to wash away any during the winter, as the soluble parts will have been carried down into the soil by rains, and the grass or clover roots will take care of them. Great pains should be taken to spread this manure as finely as possible. We use a manure-spreader, which does the work very perfectly. If spread by hand, one may harrow it



THE KEMP MANURE-SPREADER.

Prices from $85.00 to $120.00. All inquiries must be addressed to the Kemp & Burpee Manufacturing Co., Syracuse, N. Y.

with a smoothing-harrow, or bush it; and I would do this most thoroughly even, if possible, until hardly a trace of the manure could be found. Perhaps you may think I put this too strongly, but I mean it all. In many cases the farmer could realize double what he does from his manure by making it so fine that every bit of soil would have some, instead of its being turned under in lumps. I have traveled thousands of miles this spring, and seen field after field thus carelessly manured. Why, it seems sometimes as though I must get off the train and go and show the farmer what he is losing. I have spread manure as carefully and evenly as possible in the fall; and then, when it was rather coarse to use a smoothing-harrow or bush on, I went over it three or four times in the spring with the cutaway harrow. This was on clover sod. You ought to have seen how nicely it fined the manure, and worked it into the surface soil. Manures so spread in the fall will be worked into the soil in the best possible shape for potatoes, if you do your part. I would not, as a rule, spread manure on plowed ground or stubble land in the fall. It is a wasteful way, as well as the fall plowing. In the spring, when you plow a sod manured as above, in the way described in the first chapter, you will have a good foundation for a potato crop.

I can not advise the application of fresh manure during the winter and spring, for potatoes. No, it will be wiser to keep it over and put on in the fall for another year. Fresh manure is more liable to produce rot, in a wet year, and scab is likely to be made worse by it, and the quality of potatoes will not be as good. This is simply a general rule. There are exceptions. I know men who follow this practice. It seems to be all right for them. But I have learned not to risk it, by bitter experience, and so have many others. I once manured a field with fresh manure through the winter and spring. The yield was large, but they were badly scabby. The other field, the same year, without any manure but clover, gave an entirely smooth crop, as usual. I could have

sold the product of the last lot readily, at a good price; but in order to work in the scabby ones I had to take five cents a bushel less for the whole lot, and hunt long for a customer, and sort out some 200 bushels of the worst ones. You don't know how this hurt me, to work off four or five cars of potatoes in this way. You may safely draw manure out fresh for corn; but I would not take the risk for potatoes. When a dry season follows the application of fresh manure to potato-land, I have had the yield actually reduced by the manure, and then so much was left that the wheat following was overfed, and got down so badly that we wished we had never put any on.

I would never bother to put stable manure or compost in the hill or drill in field culture. It takes a good deal of time in the busy season of the year, and I think it is no better than to apply it broadcast and finely pulverized in the fall. If it is finely pulverized, and mixed with the soil, the roots will find some of it as soon as they start, and they will surely find it all in time, as, before the tops are nearly full grown, if you plant as near together as you should, little rootlets can be found in every square inch of soil, searching for food; and it is better that they should find their food widely and deeply scattered, as then, in case of drought, they are in better shape to get all the moisture there is in the soil. Manure in the hill may give a quicker start; but it is the steady, healthy, vigorous growth from beginning to end that fills the basket the most times on an acre.

It is now no use for the great majority of growers to try to get the earliest potatoes into market to secure the high price, as some farmer living further south will have them before you do, and ship them up and supply your market before you possibly can Here in Northern Ohio, potatoes are now sometimes lower in July than in November. We must strive to raise the largest possible crop at the least possible cost. Broadcasting the manure will help us, I think, to do this.

Manuring the Renovating Crop.

I have now given you what I believe to be the best way of applying manure directly to the crop, and perhaps I shall surprise you when I say that I believe a potato-grower can do better than this. I have given the above because it seems to be the best that one can do who follows the common practice of manuring the crop directly, and people will be slow to change. The idea of putting the manure on to the money crop, or the one taking the most hand labor, so as to get profitable returns, has a strong hold on the minds of our farmers. It had me once, but it has lost its hold. To show you what I mean, I must go into the matter of rotation a little before we come to it regularly in a later chapter.

We follow the best rotation I know of for a potato-farm where no stock are kept—a three-year one of clover, potatoes, and wheat. The clover is the renovating crop, you know. It draws on the air and subsoil as well as on the soil, for nitrogen; and it pumps up mineral matter. If we can make it big and strong enough we can get all the fertility we need for pretty good crops of potatoes and wheat. If, now, we use the manure to make the clover grow big (put it on the young clover), will it not then be stronger and ranker, better able to send its roots still more deeply into the subsoil, and to gather still more nitrogen from the air? Again, clover is the safest food we can feed potatoes. It is least likely to produce scab, or rot, or to do harm in a dry year. The potatoes so fed will be of as fine quality as can be grown. I mean, of course, those fed on the clover-roots (a clover sod turned under), and more or less of the tops. Again, the manure can be put on at a time of year when we have the least to do, and when, as a rule, the ground is hardest and dryest, and when we shall do the least injury. Please turn over and read the chapter on rotation and clover-growing, and you may realize more the value of using manure on the renovating crop. Since the writer began to practice and preach this, one by one, some of the best authorities in the

land, have come to his side. I certainly believe I am exactly right on this point, for my rotation. I was at an institute at Franklin, Pa., the other day, and Secretary Edge remarked: "The man who can get a big clover crop can do just any thing he has a mind to." That is a good deal the way I feel.

Let me now give you the plan we are at present following. Manure is saved with care, on cement floors and in a covered yard. It is put on the young clover right after we get our wheat in the barn. It is put on with as much care to have it fine as I have advised above. It is put on the parts of the field where it is most needed; and much care is taken to do this, as we never have enough to go all over. I notice particularly, when cutting the wheat, where the manure is wanted. Small clover may not need manure. It may be small because the wheat was very heavy and kept it back, and the land be rich enough. Where the wheat was thin and the clover small too, a double dose is needed. You see the point—we use our manure with the utmost care to help us get a heavy growth of clover all over the field, on every square rod, and then we are all right for our future money crops. Some reader may think that manure put on the surface in midsummer will lose much of its value by evaporation. This is a common opinion, but not founded on fact. I have often seen farmers draw manure out and put it in piles, and not spread it until just as they were ready to plow it under, so as to prevent any loss. Did they ever stop to think that, if this world had been made that way, fertility could not have been built up on the surface? There was no one here for ages to plow under the manure of animals or the growing vegetation; no, they remained on the surface, and eventually the soil became rich. You can not practically evaporate nitrogen, phosphoric acid, or potash, and these are the three ingredients that we need in the manure. Did you ever boil down any lye in a kettle? Did the potash evaporate? No; it remained in the bottom, and water only went up into the air. Just so if you set a pan of water

and potash out to slowly evaporate; just so if you put in nitrogen or phosphorus. These substances will not evaporate in the form given above. Under no combination of circumstances can you evaporate any mineral matter. But if you pile up your manure and let it heat, thus changing the nitrogen into a volatile gas, ammonia, and you spread this manure out, the ammonia will go to waste at once. But you will lose only the trace that was present when you spread it. After manure is thinly spread, practically no more will be formed. The slight amount you lose is of little account. Doubtless you would lose as much every day if you left the manure in a heating pile, where ammonia was constantly forming. But practically I keep my manure from heating and forming ammonia, by having it spread all over the covered yard, and tramped so as to pretty much exclude the air. The manure does not rot. I do not want it to. I want to use it on the surface. It has two values I am after, and at the same time I do not want any loss. The first value is the actual plant-food in it. This, I have shown you, I shall get without any practical loss. Then by using it on the surface I get a mulching value. Little by little the rains leach the plant-food down among the clover-roots, where it will be taken care of. Meanwhile the refuse portions, straw, etc., shade and cover the surface between the young clover-plants. It is a great law of nature, that bare land grows poorer and shaded land richer. Our farming will become more and more profitable as we learn to work in accordance with the laws that are fixed by the great Creator of all. Do you think this manuring will interfere with your having clean hay the next year, if you want to cut the first crop for hay? It does not at all on my farm. The manure is so finely spread that it decays so not a trace of it will rake up in the hay. I feared trouble in this way, but have had none. But, remember, we have a manure-spreader, and it tears the manure all into shreds, nearly, and the heavy growth of clover furnishes moisture and shade, so it decays quickly.

If poorly spread it might not only not decay, but would smother some clover.

How much manure shall you put on? Well, applied in the above way, and for the above rotation, I would, if I could, use enough to grow as heavy a crop of clover as could well grow, both the rowen after the grain, and the first and second crops the next season. The potatoes would stand higher feeding, but the wheat would get down, and will some any way. A gardener may often to advantage make his soil richer than is wise for one who grows grain in rotation with potatoes. My friend J. M. Smith, of Green Bay, Wis., grows much larger crops than I do. His climate is more favorable, any way, and then he manures very heavily and rotates with garden crops which will stand it, and, in fact, need it. But it would not do to put grain on his land, and he does not have to grow clover to get cheap fertility, as he buys quantities of manure cheaply in the city near by. Mr. Smith averages, I think, over 300 bushels of potatoes per acre. In this latitude, and grown in a grain and clover rotation, I think one will do well who gets an average near to 200 bushels, and, say, 25 to 40 of wheat.

Commercial Fertilizers.

I had half a notion to skip the fertilizer question entirely. I confess I do not understand it. There are good men, and true, who report wonderful results from the use of fertilizers on potatoes, who consider them just as truly plant-food as stable manure, and who say no other manure should be used for potatoes, as fertilizers grow the smoothest and best ones. Clover and fertilizers are spoken of as all that is necessary, and good old manure takes a back seat along with the hoe and scythe. I have no right to think these friends any less honest or sincere than I am, but I can not agree with them. I must be governed by my experience. Several times have I tried fertilizers with great care, and you may rest assured

the manufacturers would not send me a poor article. I will tell you of one experiment.

S. C. rock phosphate, pure ground bone, and Mapes potato-manure (a so-called complete manure for potatoes) were used. Muck had been applied to the land, which contained much nitrogen, and potash was abundant naturally, and so in theory the rock phosphate was just what I wanted. The complete manure, containing every ingredient necessary for the growth of a crop, was certainly all right, but it might cost too much, as some of the ingredients, might not be needed. Experiments were made in three different lots, on strips 50 to 60 rods long, using at the rate of 600 to 1000 pounds per acre. Great care was used in the measuring, weighing, etc., that the experiments might be accurate. I will not take space to give full details, but will simply say that, much to my surprise, no benefit was derived from any of them. There were slight variations in yield, but no greater than could be accounted for by the natural variations of the soils. It was a wet season. The next year was quite dry, and the same ground was in potatoes again, but no difference in growth or yield could be seen on these plats.

The experimental rows in one case ran across a piece of rather poor land, where the yield was much below the average. Here, I thought, surely I should see good results, but was disappointed. Rotten stable manure will increase the yield every time, even when the land is already quite rich; now, why will not a complete manure, containing all the ingredients of stable manure, do the same? Why did it not show some effect on poor land? Rotten manure would have done so. That same season, by the use of stable manure, freely applied, a half-acre was made to yield more than 200 bushels.

In spite of these experiments, when a circular came one spring, with a picture of a fine large potato (450 bushels per acre) grown with the potato-manure, and a little scabby one (120 bushels per acre) grown with animal manure, I could

hardly resist the temptation to order a carload of the fertilizer—there was such a difference in the potatoes (in the picture)! This is not told to condemn the use of all commercial fertilizers, but rather to induce farmers to experiment more, and know what they are about, and whether a thing pays or not, and not to trust to theories and fine circulars, or even the experience of others entirely. I have no doubt that fertilizers in bags sometimes pay; but do they pay *you?* that is the question. Figure and experiment carefully, and see. A thousand pounds of complete potato-manure, put on an acre, would cost, in Ohio, perhaps $25.00. It is a big question, whether you can not better get the same amount of fertility, and in a shape that can always be depended on, in $25.00 worth of wheat-bran and oil-meal, to be fed out with your straw and corn fodder. Then you will be your own manufacturer, and you will get the feed value for your labor in the winter when there is not much else you can do.

I am perfectly willing to go on record for all time as advising this plan; but in regard to the use of fertilizers, please remember me as cautioning you to keep your head and know certainly whether they pay you before investing in them to any great extent. They certainly can not always be depended on like good stable manure. I do not stand alone either in this view, by any means. At the best, fertilizers are expensive for the mass of farmers, who get common prices. My advice to such is, to do just as I have done—arrange to save all the manure you do make, with great care, and grow clover for all it is worth. I believe you can thus avoid buying nitrogen, at least for a long time. In the older-settled localities, mineral matter may be needed now, or soon. When it is, experiment and get it in the best way you can.

Granting that fertilizers are as truly and surely plant-food as good stable manure, growers near large cities, who get about two prices for their products, can well afford to us

them. It doesn't follow, however, that the great mass of farmers in Ohio, say, can afford to use them at the prices they get.

Since writing the above, Bradley's fertilizer book has come to me. There is a beautiful picture of Chas. Hummel's potato-field, with baskets of fine tubers standing as dug—350 bushels of large smooth potatoes per acre, from 1400 pounds of fertilizer per acre! and Chas. Dibble's wheat—37 bushels per acre, and an average in the county of only 18! and friend Collingwood, of the *Rural New-Yorker*, saying: "There are many thousands of farmers in New York State who use a ton of fertilizer per acre, plain business men, who ten years ago were buying large quantities of stable manure, and to-day you could not get them to pay 50 cents a cord for such manure and haul it home!" How this excites me, with all my adverse experience! I can hardly keep from ordering a carload at once! But, alas! I am one of the "many thousands" who can not show such results. If this book could be delayed till fall, I would put 1400 pounds on an acre again this year, and try it once more, paying the regular price for it, so my report might be from a disinterested standpoint.

My farmer friends, be perfectly sure you are right in this matter, and then go ahead. My old friend J. M. Smith, whose opinion Uncle Sam has not gold enough to buy, said at a late institute: "Fertilizers have never paid me on good or poor land." Prof. Thorn, Director of our Experiment Station, after a great amount of study, in his bulletin, "Forty Years of Wheat Culture in Ohio," says: "These statistics indicate that the wheat crops of Ohio have been slightly increased by the use of commercial fertilizers; but it appears that the average cost of this increase has equaled its market value."

CHAPTER III.

When and How Far Apart shall we Plant?

The ground having been properly prepared, and sufficient available fertility arranged for, the next question that comes up is, When shall we plant? No fixed rule can be laid down, with any certainty that it will be the correct one for that season, until we can tell beforehand just what the weather will be. The plan which I stick to is, not to start the plow until the ground is dry, and then plant as soon as I can get ready. This rule followed out every year for my farm, and the medium early potatoes I grow, gives, I think, the best results. Of course, we miss it now and then, as we should if we planted at any fixed time. But we think the average results of early planting are best. I have had early-planted potatoes injured by dry hot weather during the last two or three weeks of their growth, while those planted a month later lived through the dry time, and made a fine growth during wet weather which followed the drouth, and yielded double what the early-planted ones did.

In 1884, a killing frost the 29th of May cut down into the ground half of our potatoes that were planted early and were up high enough to cultivate. The other half, planted a few days later, escaped the frost and yielded much better. But such a frost comes only once in perhaps ten years, and I will take the chances on it, and plant early, regularly. With favorable weather right after, potatoes may not be injured greatly by being frozen down. They will come on again any way, side sprouts coming up from the main stem. A slight frost, that only blackens some leaves, is of little consequence. We seldom get a frost that kills the stems into the earth, as mentioned above.

I have now given some of the objections to early planting.

There are many advantages. We are quite likely to have showery weather here in July, and that is a good time to have a crop ripen. It is a great advantage to have them ripen slowly. Blight seldom injures the early-planted early potatoes. They are out of the way before blight weather gets around much. The crop is secured before the hottest and dryest weather of the season, as a rule. The spring moisture, by careful tillage and by having plenty of vegetable matter in the soil (clover plowed under), can be made to carry a crop through pretty well, even in a bad season. We can get crops off during good weather and long days, and get a grain crop growing in good season. An early crop is very seldom injured by rot. There will be now and then a year when the early crop can be carried through so as to yield quite well, and a dry hot fall injures the late crop seriously. The early man has his crop made, and reaps a rich harvest then. We have done just this thing, time and again, while it is seldom that the late planting will give much better results than the early. This is my best opinion, from long experience and observation—that a skillful man in Ohio will make the most in the long run by early planting. But we do not sell early. We dig as soon as ripe, so as to put in wheat, but sell when we can do best—usually, late years, along in October.

In this latitude, Ohio, I would not plant at a medium time. If not early, wait until late, and have potatoes ripen during the cool weather of fall. Many large growers all over the country practice this plan. They have one advantage—they can sell from the field as they dig, and will lose less shrinkage; but they do not have as good weather to do their work in, as a rule.

It must always be remembered, however, that it takes land rather better fed, other things being equal, to grow early potatoes. They ripen in less time, and before Nature has had as much chance for making available plant-food. You need to assist her a little more if you hurry her up. I

remember hearing a farmer, whose potatoes were badly cut down by frost, say: "You will never catch me this way again. I shall plant late after this." Well, perhaps a late drouth may catch him next, and then he will never plant *late* again. This is a very unwise way to do. Study over the matter, and decide, according to your experience and what light you can get, what plan it is best to follow in your locality, and then stick to it through thick and thin. I have had to endure being told I was in the wrong boat, two or three times, and thoughtless persons made a great ado about my short crops; but I know my business, and dare to stick to the best way.

About fifty friends write to me in the course of a year, to assure me that it makes a difference what time of the moon potatoes are planted. It is easy to see how one can be led to think so. Very slight causes will change the yield of potatoes. A single shower and a few cool days at just the right time may put fifty bushels on an acre. If this acre happened to be planted at the right time of the moon, and others not, how natural to attribute the result to a wrong cause! I don't care any thing about the moon, myself; but I do dread a week of very hot sun, particularly if it is dry. If the thermometer reaches 95 to 98°, the potatoes will suffer in spite of all man can do.

Distance Apart.

In regard to the distance apart that potatoes should be planted, two matters are to be taken into account. First, the shading of the soil keeps it from drying out as much as it otherwise would in dry hot weather. The moisture from a shower will be longer evaporating. More of it will evaporate through the leaves of the plant, and less from the soil directly, when the potato-tops cover the surface. The soil will be enriched by the shading also, or the tendency will be that way. Therefore it would seem best to plant near enough together so that, in a fair season, the vines shall

grow together, almost like a crop of clover, shading the surface quite perfectly.

Second, the distance apart that potatoes should be planted depends somewhat on the richness of the land. With wheat, the richer the land the less seed should be sown, because it will stool out more on rich land than on poor; but with potatoes, just the reverse seems to me to be true. The richer the land, the nearer together we may plant. The idea is this: There is only a certain amount of plant-food available for the crop, therefore vary the distance apart as nearly as you can, so that there will be just about enough potatoes set to use up all this food in growing to a good nice size. If you plant too far apart, the available plant-food will not be all used up, and your tubers may be too large; if you plant too near together, there will not be food enough, and the result will be smaller potatoes. Of course, as seasons vary, you can not expect to be always right; but you can come nearer to it than if you put in your seed without any care or forethought.

Now, with these two matters in mind, try to come as near right as you can. For the medium-early varieties that I grow, and my soil, drills about 32 inches apart, and a piece of seed from 13 to 16 inches in the drill, seems as near right as I can make it. This pretty much covers the surface, and still is not close enough to make tubers smaller than my customers want. If I wanted tubers larger, I would drop pieces farther apart in the drills. Thirteen inches apart has been our rule; but a variety like the Freeman, which is inclined to set a good many in a hill, will, I think, do better at 16 inches apart. They will average larger, and still not too large. I tried them 32 inches each way, and some grew altogether too large, and the yield per acre was not nearly what it was with a piece every 13 inches in the drill. Of course, the variety has much to do with the distance apart they should be planted. Some of the strong-growing late varieties would better be planted in drills 36 inches apar

and will well cover the surface then. Varieties that have small tops, and set few tubers, such as the Early Ohio, will bear putting closer together, or using more seed than one eye in a place, as we do. Still, Mr. J. M. Smith told us at the great "round up" institute in Wisconsin this spring, that he planted the Early Ohio, cut to one eye, as I do, about 13 by 32 inches, and he raises very large crops. But the land is very rich, and he says the tubers grow very large. You see, it is impossible for me to tell you just what to do; but perhaps I may set you to thinking on the right track. If your land is poor, and you plant far enough apart to get good-sized tubers, you see you will then lose part of the benefit of the shading of the soil. Does it bother you to see how to manage this? Only one way—make your land richer, and then you can plant closer, and shade it more, and make it grow richer still. Unto him that hath shall be given, every time. It seems hard, but it is Nature's law. Oh there are so many things that we must attend to, to do our best, even about as simple a matter as growing potatoes! I have been amused, many times, when they have put me down at an institute, to talk on potato culture, when I asked them what particular point, and they would say, "Oh! all about it." Friends sometimes write me and ask me to write them in a letter all about it.

I have a photograph of one of my potato-fields, taken when the growth was at its best. I wish it could be reproduced for this book, but the vines would not show plainly. The other day it was shown to a number of farmers, and all but one said it was a field of clover. Strangers, in riding past in the summer, if they did not notice particularly, would think it clover. It was an almost perfectly even mass of foliage. This is my idea of what a potato-field should be. We have attained to it several times, but not always by any means. We came the farthest from it last year we ever did, perhaps, on account of the excessive rainfall, which made poor spots in the field. I would not care to show you a picture of last

year's field, if I could. But still we made some money, and our loss was very small compared with that of some whose land was not drained. We are as ambitious as ever to try to get a perfect field this season.

Perhaps you do not suspect from reading these pages how much pains is taken to have every thing carefully explained and correct. My way is, to write a chapter and then lay it aside, and let it get cold. Then it is read and corrected, and perhaps all or part is re-written. I have a way of asking myself, first, "Is every word exactly true?" "Why, you would not write what was false," you say. "Oh, no! But I should not be human if I did not sometimes paint a picture a little too brightly, or bear on to some point too strongly." Second, "Can any thing said, although strictly true, be misleading, or has any thing been omitted that would have given a different color to the statements?" When I can do no more, the manuscript goes to my partner (wife), who reads it carefully, and returns with comments. Right here let me say that fully half of my little success as a farmer and writer belongs to my partner, who takes care of the home, and whom you hear of so little; and she gets her share of the returns, at least, if not of the credit always.

I am now ready to give you her comment on this chapter. She quickly saw a matter that needed further explanation. She says, "You say in the book, that the roots occupy all the soil. Now, theoretically, would not hills equidistant each way, say 20 inches by 20, give potatoes the best possible chance? Would it not be better than drills with plants 32 inches apart one way and crowded up within 13 inches of each other the other? You urge the very best methods all the way through, and should explain why you do not carry it out in this case."

I entirely overlooked this point. An expert would understand the matter, but it would not be as plain as A B C to a beginner, by any means. Planting 20 x 20 inches *would* be better than 13 x 32. Each plant would have its feeding-

ground around it on all sides equally. It would not come in contact with its neighbors at 7 inches on one side and 16 on the other. But, practically, drills 32 inches apart are about as close as I can use a horse to the best advantage. Some do reduce the width to 28 or 30 inches; but most large growers do not come below 32. Thus from the necessities of the case we are prevented from planting in the best possible way. We shall have to let the roots in the drills fight a little over their feeding-ground. Planting 32 x 32 is not best, as shown in this and succeeding chapters; that is, in connection with the most advanced practices. Roots have a wonderful knowledge of where plant-food exists in the soil. Perhaps the roots along the drills will stop at 7 inches and the others at 16. Who knows? If so, they will make it average.

CHAPTER IV.

Shall we Plant Deep or Shallow?

With this question we must consider, also, whether we will cultivate nearly level, or hill up; for, if we plant shallow, it will be necessary to hill up more or less to prevent the tubers from growing out of the ground. The majority of farmers, probably, still raise potatoes by planting in a shallow mark, and then hilling up with a plow of some kind when they are about two-thirds grown. On undrained clay soil, where there is danger of stagnant water injuring the crop in a wet season, this practice had better be continued, on the ground of choosing the lesser of two evils; but in good potato soils, moderately deep planting and very slight hilling is undoubtedly the better practice. Even on tile-drained clay soil, deep planting and nearly level culture would not be the best plan in excessively wet seasons, although averaging better, perhaps, than shallow planting and hilling, all things considered. There are reasons, of course, for this hilling up which is so universally practiced. Farmers did not have smoothing-harrows, horse-hoes, and good cultivators years ago. I am not an old man, but I can remember when such things were unknown. The plow came first, and was made a general-purpose tool. It would throw earth over the weeds, and save hand-hoeing. It was, very naturally, used for this purpose. Hilling up, in connection with shallow planting, not only prevented tubers from growing out of the ground as much, and kept them out of water on undrained land, but more of the stems of the vines were covered in the earth, and from these covered portions were sent out more roots and bearing stems. The practice was a necessity with shallow planting. It increased the crop in one way, and protected it, while injuring it somewhat in another.

Nearly forty years ago I used to hill potatoes in father's garden. Father used to insist on my making the hills large and dishing, so as to "catch the rain." When I began farming I remembered the lesson, and noticed, also, that other people hilled their potatoes, and so I did likewise. If I had been asked why I did so, I should certainly have preached the catch-the-rain theory, with perfect assurance that it was sound doctrine. But with all due respect to our fathers and other people, I can not help thinking now that this plan was not in accordance with common sense. Advocates of this way seem to think the roots are all in the center of the hill, right under the tops. But, what are the facts? If you will wash out a hill in mellow soil, you will find, before the tops are half grown, that the little rootlets have crossed and recrossed all the space between the rows, and, of course, they want their water as well as food, just as much there as under the hills. If the surface of the ground is kept level, or nearly so, a shower soaks in all over alike, and each root gets its share. If the seed was put in moderately deep, and the surface is kept nearly level, and constantly stirred, the crop is in the best shape, not only for catching rain, but to endure hot dry weather—one of its greatest enemies. Suppose one hills up his potatoes with a shovel-plow, what does he do? He piles the mellow earth, which should make a mulch all over the surface, up about the hills. This is well, perhaps, if he could get as much more to put in between the rows again; but instead he leaves this space (where a part of the roots are), bare, hard, and exposed to the hot sun. If he should cultivate it again he would injure the roots, which are now at the surface (not a few also were entirely destroyed by the plowing), and the soil in the hills will certainly dry out more than if it were down nearly level, and protected by a mulch of fine earth. Some think that the crop must be hilled up, or they will grow out of the ground and be injured by the sun. After raising many thousands of bushels with but very trifling hilling, I do not find as large a proportion

greened as when I hilled them up. We generally use a horse-hoe once during the season, to throw a little earth under the plants when they are about half grown, so as to check the weeds which are just starting in the hills; after that the shade from the tops will keep them down. The use of the cultivator, as many times as it ought to be used during the season, will work a little earth toward the plants, so that, altogether, perhaps, the hills are two or three inches higher than between the rows when we are through cultivating.

I have hastily spoken of the level field catching the rain best. Let us consider more particularly how important this is. Suppose your field is somewhat rolling, and potatoes well hilled up. A heavy shower comes along. Most summer showers are heavy. The water runs rapidly off the higher portions of the field in the little ditches you have made, and either leaves the lot entirely or accumulates in the lower parts. This is all wrong. Where you want the water most, it does not stay. See? Where you want it least, in the low places, you get too much, perhaps, or you lead it off the field entirely, and, later, your crop suffers for want of it. And there is more or less fertility in the water of every summer shower. It gathers ammonia, that has escaped from the manure-heaps of careless farmers, as well as that from other sources, out of the air as it comes down; and it is a positive loss of fertility to let water run off over the surface of your field, and carry fertility with it. A part of these losses, often nearly all, can be avoided by good drainage first, natural or with tiles, and then nearly level culture, and at the same time we may get every possible advantage that ever came from hilling up, except on heavy land in a very wet season, perhaps.

On my land I have settled on four inches deep as about the right depth to plant. I would put seed a little deeper rather than shallower. By managing rightly, with smoothing-harrow and otherwise, there is no trouble, as a rule, in

keeping a crop clean without any hand-hoeing, and to do it more cheaply, as will be told of later on. So there is no need of hilling any longer to keep weeds down. By planting four inches deep, and the slight hilling spoken of, we get a depth of underground stem sufficient for throwing off roots and tuber-bearing stems, just as practically as though we planted shallow and hilled up. It may occur to you, whether deep planting and hilling would not be better yet, as furnishing still more underground stem. No, not practically, because you can not use any more plant-food than there is present, and my plan will use it all up. We want a proper balance in all these things. I should say right here, that I am writing with reference to drill culture, which I consider best, and will speak of in another chapter. For hills three feet or more apart each way, possibly deep planting and high hilling together might give a better return than deep planting and slight hilling, notwithstanding the injury done by hilling to roots, and waste of water, etc. But it will not, as a rule, give as good results as proper deep drilling and slight hilling. All good things need to go together. It is a deep study, their relation to each other.

You will notice I do not speak of "level culture." The term, although in common use, is misleading to those not posted. Exactly level culture is not at all practical, except during the first part of the season. A little earth must be worked in under the plants, for reasons given, usually; and then, again, the expanding tubers will crack the soil and let in light, to their injury, if the surface is entirely flat. I advocate exactly what I practically do, and have briefly given you the reasons for our practice. I could fill page after page with experiments in different lines, but they are dry reading to the ordinary farmer. He wants conclusions—just what to do—just what the man he is reading after is doing. This I give you. It is not all right, doubtless, but it is the best I now know. Reader, if you still hill up potatoes, as your father did, can you not see from this chapter that my reasons

for not doing so are founded on simple common sense, as well as long practical experience?

CHAPTER V.

Shall we Plant in Hills or Drills?

When the country was new and land cheap and rough, and tools of the poorest kind, and farmers generally raised only about what potatoes they wanted for their own use, hill culture was well enough; but now there are many reasons why the farmer who wishes to do the best he can should give up the hill planting for good, and put in his crop in drills. It requires less hand work to keep the crop clean if you can work it both ways, is the usual reason given for planting in hills. That was all very true a few years ago; but now we have so much better tools that it is possible to put in the crop in drills, and keep it quite clean without any hand work or hoeing at all, as a rule. The main argument, therefore, is easily disposed of. Another argument is, that it is more work to drop the seed (there are more pieces to be dropped) and more work to dig the crop. Yes, and it is more work to mark out both ways than one way. However, we have a machine to do the dropping now that never gets the backache. It would just as soon drop three pieces a foot apart as one piece every three feet. If the digging is done by any of the patent diggers, the same rule holds good of them. I asked a man once who had dug many thousands of bushels with a fork, in my fields, where they were drilled, whether it was any more work to dig an acre of my drilled potatoes than it was to dig an acre where they were planted in hills. He said it was not, for him. Now, he had got the hang of it. In the drills he could throw out all the tubers under one plant by a single motion of the fork, usually, and three motions or movements would throw out

the potatoes from as much ground as a hill would occupy. And it would take about three movements of the fork to throw out the hill, on account of the potatoes being more scattered, and more of them.

Having disposed of some of the objections, let us look at some of the advantages of drill culture. To accomplish the most in the least time, by saving the time wasted in turning around, the farmer wants his fields long and rectangular. He can mow, plow, cultivate, and plant more, decidedly, in a day, than he can in a square or irregular shaped field. Now, drill culture works all right in fields of this kind, as the cultivating is all to be done one way—the long way of the lot. If you plant in hills both ways, think of the endless job it will be to do the cross-cultivating, there will be so much turning around. Again, with the planter or with perfect tools for marking, so the rows are straight, or very nearly so, and of uniform distance apart, and with the best cultivators and horse-hoes we have now, and the smoothing-harrow and weeder, one can keep the crop as clean and well worked by going once in a row where they are drilled as he could 20 years ago by going twice in a row each way. In fact, he can keep the crop as clean as any one can ask for, as a rule, and as well worked, and in very much less time. My best six-acre lots, or strips, are about 16 rods by 60, and it would surprise a man who has been in the habit of cultivating a square six-acre lot both ways, to see how quickly we can get over a lot of that shape, and do the work just as well as he does. I can cultivate my six acres of drills nicely in ten hours. If he cultivates his square lot both ways in three days he will do well; that is, if the rows are as close together as mine are. Again, we get a rather better yield, all other conditions being equal, by dropping one eye every foot than by putting three eyes in every three feet, and the potatoes are of more uniform size. After many years' experience in drill planting I feel perfectly sure on this point—perfectly sure that we get more dollars to the acre. It is quite easy to

mark out drills one way that are very nearly straight, and four or five inches deep; but it would be much more work, particularly in a long, narrow field, to mark them out both ways. Then in showery weather, when planting in drills one can plant right up as fast as he marks; but if he has to mark both ways he may get caught and have to do the job all over again. Then if the planting is to be done by machinery it must be in drills, as no planter will probably ever be made that can drop potatoes and row them both ways. Potatoes will be planted by machinery in the future, as a rule, by large growers, undoubtedly. As the planter is now made I have my doubts about its being best to use it in all cases; but it will be improved to do the work rightly. But of this more will be said in the proper place. Manufacturers of the planter told me that, when first introducing it, the worst trouble they had was that growers objected to drill culture. I did not, for I had learned it was best for me, a number of years before the planter came around.

In connection with the subject treated in the last chapter, there is a point that may as well be brought up right here. I can grow potatoes of a finer quality in drills than in hills, unless the hills are hilled up in the old-fashioned way. In other words, drill culture and nearly level culture should go together. One may not always be advisable without the other. Let me illustrate: I drop, we will say, a one-eye piece every foot in the drill, in my drill culture. Perhaps four or five good-sized tubers, not over large, but of quite uniform size, are the result in each hill, or every foot in the drill. Now, when they expand as they are growing, they crack the ground, of course; but, as there are not many in a place, not very much. The little earth that our slightly ridged culture puts under the plants prevents light from getting down to the tubers, and they are not only not green, but not even yellow. Potatoes are often ruined, when not green on the outside. Now, suppose the potatoes were planted in hills three feet apart each way, and three times

as much seed put into a hill. It would not be too much, perhaps, or more than is generally used. Say you have, as a result, 12 or 15 tubers in a hill. Will they not crack the ground very much more? Of course. If it is nearly level they must bulge it up considerably, and you must either hill up decidedly more, or have your tubers injured. If the light gets down into the soil in cracks, and tubers are near these, they will be injured in quality.

A word more about hilling: Did you ever notice how the tubers naturally grow in the soil? They form on the stems about the plant, and, as a rule, the stem end (so-called) is slightly higher than the other. Practically the tubers lie about the hill in a nearly horizontal position. Now, in such a hill as one can make in narrow rows, and with the tubers forming, from shallow planting, in the raised hill, can you not see that the ends of potatoes of the long varieties would most naturally stick out of the hills on the sides, or nearly so? With deep planting and slight hilling, can you not see they would just as naturally form in the soil, where the seed ends would not stick out? With a little study you can see the reason why we do actully raise potatoes less injured by exposure to sun and light, by nearly level drill culture than we used to in hills. Of course, if the hills were far enough apart to furnish plenty of earth to make broad enough hills, the tubers would not protrude any more than in nearly level drill culture; but this plan would be wasteful of ground, and wasteful of fertility and moisture, from the lack of shade.

With proper management, on suitable soil, drill culture, deep planting, and very slight hilling, promise the up-to-the-times grower of to-day the best returns it is possible to get, and at the least expense.

CHAPTER VI.

How to Make the Drills and Fill Them.

The ordinary markers do not make a mark deep enough for potatoes, if nearly level culture is practiced. They would do better for corn. A light one-horse plow does very well; and by running it twice in a row, as I have known some good farmers to do, a very fair drill can be made; but they can hardly be made straight enough so that the cultivating can be done to the best advantage; and then it is too slow for this fast age, particularly if one raises very many acres.

Feeling the great need of a marker that would make nice straight drills four or five inches deep, fast, and leave the earth so the drills could be rapidly filled by horse-power, and finding nothing of the kind in the market, the writer, some years before the planter was offered to the public, made such a tool for his own use. It gives excellent satisfaction, and he believes that, by its use, he can put in potatoes on his farm in the best known manner. The planter will be spoken of in the following chapter.

The marker consists of two light plows, one right hand and one left, with the mold-boards toward each other, attached beneath the axle of a two-horse sulky, so that they can be adjusted at pleasure, and can be lifted out of the ground, and fastened up at the end of the rows while turning around. Fig. 1 shows a top view of the main frame. A is the pole; B the axle; C a cross-piece; E the doubletree; D, D, two pieces of wood of the same thickness sidewise as the plow-beams, bolted under the axle and cross-piece, and directly over the plow-beams. The pole is also bolted under the axle and cross-piece, and is braced as shown in the cut. F, F, are the draft-irons which run under C. One of them is shown more fully in Fig. 5. The whiffletree is put on the

hook shown at the end. The iron on the under side of C (Fig. 5) is slotted for F to pass through. The line of draft is changed by means of a bolt passing through different holes.

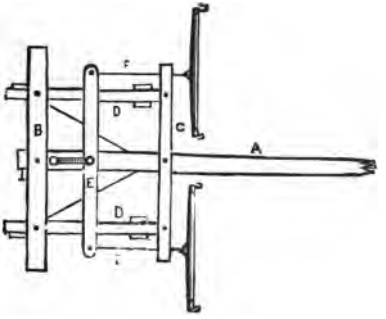


FIG. 1.—TERRY'S POTATO-MARKER, AND ITS ATTACHMENTS.

F goes under the bolt, of course. Fig. 4 shows the iron that one wheel runs on. One of these is bolted to each end of the wooden axle B, on the under side. In Fig. 2, K shows

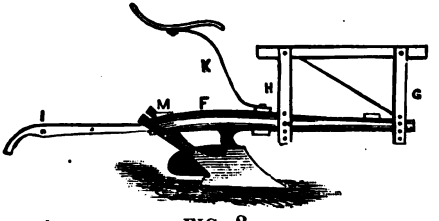


FIG. 2.

the spring seat, without which no tool nowadays is complete. A side view is shown of one piece, D, the top of which is shown in Fig. 1. F is a side view of one plow-beam, and G is one of the pieces of hard wood by which the plows are drawn. There are four of these pieces, one on each side of each plow-beam and of each piece D. Remember, that these

strips, D, D, are of the same thickness as the plow-beams. Each one of these four draft-pieces is strongly braced; one brace is shown in the cut. A bolt runs through G, and through a hole in the plow-beam, to draw by. A number of

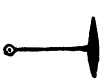


FIG. 3.

FIG. 4.

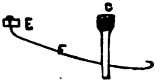


FIG. 5.

holes are bored in the pieces G, so that the plow can be set to run deeper or shallower. The ends of these four pieces, G, are shown in Fig. 1. There is only one piece, H, to each plow. The ends of these are shown at the rear of axle in Fig. 1. They are braced on the outside to the end of axle. A bolt running through one of the holes, shown in the lower end of H, holds a little block on which the plow-beam rests; and these blocks, one under each plow-beam, prevent the plows from going too deep, while the weight of driver, on the seat, keeps the plows down tight to the blocks. This makes the marks always of one uniform depth. The handles are sawed off the plows, and the two plows are bolted firmly together by means of cross-pieces, the ends of which are shown in Fig. 2. The seat, K, is attached to one of these cross-pieces in the center, in line with the pole. Two of the handles that were sawed off are bolted under M, and between the cross-pieces at the base of seat, and are used to lift the plows at the end of the rows. A spring latch, attached to the cross-piece at the base of the seat, catches on a screw-bolt (shown at the rear end of pole in Fig. 1), when the plows are raised, and holds them up. To let the plows down, take hold of the handles, and press finger-iron under side at I (Fig. 2). This is connected with the upper end of spring latch by a piece of copper wire.

For making a mark to drive by (the first time through use stakes, of course), a strip of wood is fastened by a bolt near the end to the center of cross-piece M. In the other end of

this strip, the iron shown at Fig. 3 is fastened by a screw-bolt, leaving it loose enough to turn easily. Having marked to the end of the rows, step off the plows, raise them up by the handles, turn the team around, then turn this strip around, fasten with a pin, let down plows, get on the seat, and drive on. The length of this strip, from the center of bolt on which it turns, to the end where the iron is attached, should be just twice the distance between two rows; that is, if rows are three feet apart, make the strip six feet long. The sharp points of the iron make a plain mark on rolled ground (and the ground should be rolled to insure even marking), and all the driver has to do is to keep the pole exactly in line with his mark; then if your first mark is straight, all your rows will be straight and of equal distance apart. You want a hoe at each end of the lot, if it is fenced, to dig out the end hills with, as one can not mark quite to the fence. The points of the plows should be set under the axle, and the plows should be set to run on the points a little; otherwise, in going through a hollow they would ride on the heels and make the mark too shallow.

The strips, D, D, in Fig. 1, are set as I use them, to mark rows 32 inches apart. The rows can be made wider by setting these pieces further apart, and using longer pieces to bolt the plows together with. If you mark as deep as I do (fully four inches), you can not well make the rows nearer together than 32 inches, as there will not be room for the earth to be piled between them. The wheels I use are 52 inches in diameter. The plows used were 10—0 Oliver chilled. The slanting lansides make the marks nearly V-shaped, and fairly good to drop in; but a V-shaped follower, or cultivator-tooth, following in the rear of each plow, and making a little mark along in the center of the furrow, to drop the seed in, would help about getting the pieces in line. Dropping in a furrow, one may vary the rows quite a little. With me this marker is a tool made partly from other tools not in use at the time. The plows and frame cost about $26.

The wheels and irons they run on, doubletree, whiffletrees, and draft-irons, are taken from a two-horse sulky cultivator, and the spring seat from the Eureka mower. All the joints in the frame are simply bolted together, which makes it quite cheap.

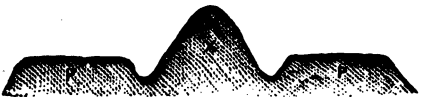


FIG. 6.—SECTION OF ROW.

The two marks, when made, look about like Fig. 6. After the potatoes are dropped, all that is necessary to cover them nicely is to level down the center-ridge X. A light scraper,

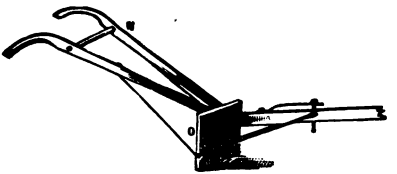


FIG. 7.—SCRAPER FOR COVERING POTATOES.

shown in Fig. 7, does this perfectly. Use doubletrees and neck-yoke twice as long as the width between two rows; the horses then walk between the rows (at P, P, Fig. 6), and not on the potatoes. The other pair of handles, sawed off from the plows, are put on the scraper as shown at N. The plank O, for rows 32 inches apart, should be about 64 inches long; and 20 inches is about the right width. The pole should be at right angles with the plank, both up and down and sidewise. This plank should be of light wood, as it is easier to bear down to make it take more earth, if it is too light, than to lift up to make it take less, if it is too heavy. The front bottom edge should have a piece of band iron fastened on, projecting down a little below the wood. This scraper carries a quantity of earth ahead of it all the time,

and pulverizes and grinds it very fine, and covers the two rows at once, in a most perfect manner, as fast as the team can walk. At the ends, cover a few hills with the hoes, beforehand.

To use these tools to the best advantage, one wants long clean fields, and the land should be made mellow and fine—just such lots and land as every farmer ought to have; but they will do good work on rough land. The marker will not tear up sods like a one-horse plow, as it is always held perfectly steady. When a man puts in his potatoes with these tools he can have the pleasure of knowing, when he gets done, that he has not only done *fast* work, but that the marking and covering have been done in the *best possible manner*. The rows are as nearly straight, and of equal distance apart, as it is possible to get them; the furrows are of uniform depth, and the covering is done as nicely as the best gardener could do it with the hoe, and twenty times as fast.

A writer in a western paper once made fun of my straight rows, and thought potatoes would grow just as well if they were a little crooked. I imagine he never kept 50 to 75 miles of potato-rows clean (perhaps he never saw that many). If he had he would know how much easier and cheaper it could be done, to say nothing of looks, when the rows are straight and of uniform distance apart.

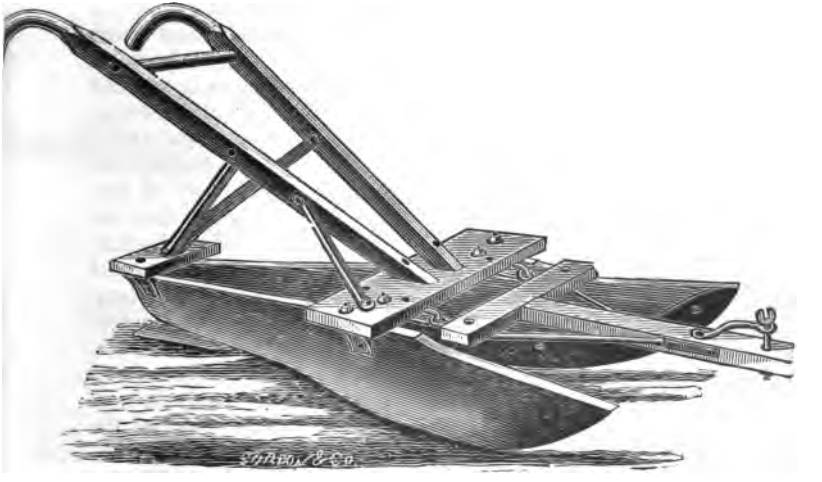
Those of my readers who have read the *Rural New-Yorker*, or that valuable little book on "The New Potato Culture," by the editor of the *Rural*, Mr. Carman, know of the *Rural's* trench system. Mr. Carman has long advocated this plan, and shown the increase in yield from following it. And still he has never claimed to be able to tell just why it was so. He has thought that, perhaps, it was partly because of the extra tillage from plowing out the furrows to plant in, and moving the soil back. If you notice closely you will see that this plan of mine is essentially the same as the *Rural's*, but adapted to field culture in a large way—made fast and simple. The writer studied it out from his own experience,

long before he ever heard of the *Rural's* plan, and used it in a large way for years. The amount of extra tillage given to the soil is great, and in the direction of loosening rather than packing. The coverer is a great pulverizer and mixer, bringing new particles of soil in contact with each other. This I think to be a valuable point. I wish we could know just exactly what it is worth. Alas! it is almost impossible for a farmer to make experiments in any line, so as to settle absolutely any matter for a certainty. We have to live by our business as we go along; and careful experiments carried through a term of years cost a good deal. A farmer like myself, by long experience and observation, and what experiments he can make, can give a very good guess as to what is best; but how I should enjoy giving the rest of my life to settling a few points in potato culture absolutely, beyond all question, and without regard to cost!

When visiting Prof. Henry lately, he told me of experiments he was carrying on to settle one point in feeding pigs. I was shown book after book of figures. He has spent already three or four years, and expects to work some three years longer, and he said the entire cost might be $10,000.

There is a little tool called the Victor potato-coverer and cultivator, which has been in use in Western New York for some twenty-five years, which is well worthy of notice here. It is so simple and cheap that every farmer who grows even two acres of potatoes can afford to have one, whereas he could not afford a planter, or the tools described in this chapter. It needs no description, as the cut shows just what it is. One man and a team of horses will cover as fast as the team can walk, whether the potatoes are in hills or check rows. As a cultivator it is used just as the tops are breaking through the ground, to throw another light covering of earth over them, thus killing all weeds in the hills or between them. This practice of throwing a little mellow earth over the sprouts just as they appear above ground is quite common in some sections. In the fall of 1886 the

writer saw large fields in Western New York as clean as his own at home, where no harrow or hoe had been used. They were worked with this above-mentioned implement. Just as the sprouts of the potatoes were breaking ground, the coverer was drawn over the field. The little weeds were smothered by the soil put over them, while the potato-tops pushed right through again. I think this kind of cultivation ridges up the ground too much for best results; still, I



THE VICTOR POTATO-COVERER.

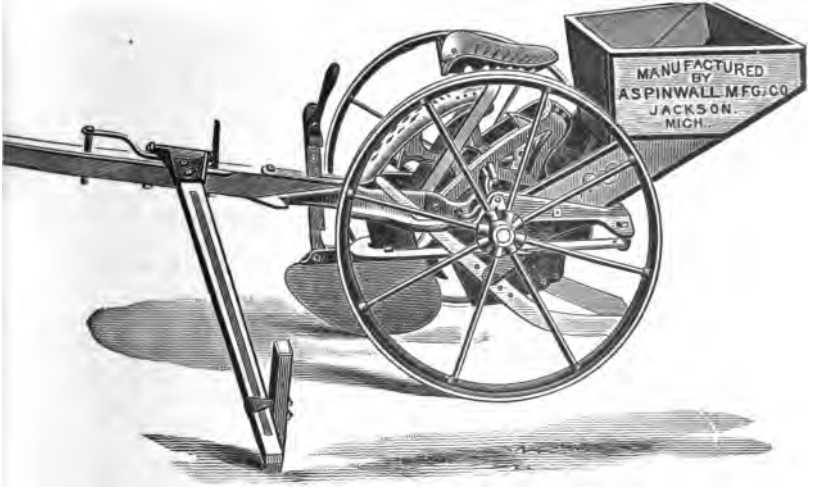
saw large crops dug. If you want to cover a single row at once, after hand-dropping, almost as good a way is to take, say, a Planet Jr. cultivator, put on the side-shovels, turned to throw earth in; use two horses, so they will not walk on the potatoes in the row, but between the rows, and you can cover one row as fast as you can walk. Many an acre have I covered in this way, when we used to plow out furrows one at a time, and after we got beyond covering with a hoe.

CHAPTER VII.

The Potato-Planter.

The writer felt pretty good after perfecting the implements described in last chapter for planting potatoes. He could do good work, and fast. He could ride, and plow out two rows at once, and make them very straight, and cover two at a time, very perfectly, as fast as a team could walk. He could get his potatoes down just as deep as he wanted them, and still not tear up the sods as with a walking-plow. When the manufacturer of the Aspinwall planter came here and tried to get me to use a planter, I did not feel like changing. He acknowledged that my machines were perfect, but his would do as well, and drop seed at the same time, he claimed. I was slow about desiring to try it, but finally did. When I got on the seat and rode, while the machine marked out a furrow, dropped the seed, and covered it, in a very perfect manner, so far as I could see, and saved my paying out any thing for help to drop, I felt that I had gone another step ahead. I watched very carefully, and found the rows could be made almost perfectly straight. The covering was perfect. I followed the machine for miles, and watched its dropping, and found that, if properly set, it would not miss dropping a piece more than about once in 35 times, on the average, which is better than some men will do. It dropped two pieces rather often, however, thus wasting some seed. If it was very high-priced, this would be an objection. The machine has many advantages. It leaves the surface in nice shape for harrowing down and killing weeds. It never gets tired of dropping. The owner is quite independent of extra help. He can set all hands to cutting seed, and rush in a crop in catching weather. It does away with the hardest job connected with planting. All these things I soon saw,

and I said then, and do now, that it is a very perfect and wonderful tool. It will drill potatoes more perfectly than any drill I know of will wheat or other grain. The planter, along with digger, harrow, weeder, etc., has made potato-growing on a large scale possible and profitable, just as improved machinery made large wheat-fields. Potatoes will be planted in the future by the planter. On light sandy land it perhaps can not be improved on materially. On



THE ASPINWALL POTATO-PLANTER.

Manufactured by the Aspinwall Manufacturing Co., Jackson, Mich. Price on board cars at Jackson, $65 00.

somewhat heavier soil, particularly in a wet season when a crop must be planted when the ground is moist, my machines will do better work.

The planter went so nicely at first that I did not experiment in connection with my old tools at all. In time I got to thinking, and did. The result was a wonder to me. The

yield from the hand-planted was decidedly greater, in two trials, on a moderately heavy loam. I did not understand it, and said nothing about it for years, but kept on experimenting and studying. I can not give the reason, to a certainty, but here are my ideas:

The plow (?) of the planter is a sharp wedge. There are some 800 pounds weight on it. to hold it down to press its way through the soil (not plow and loosen as it goes). . In moderately heavy soil, a little moist, it is easy to see how this packing, and tremendous packing too, would be injurious to a crop like potatoes, and why my plows would do the work better. Potatoes *must have* loose light soil to do their best. In a wet year, like the last, potatoes came up quicker and stronger, when put in with my machines—enough so to be easily noticed by any one. This for my soil, which is, little of it, light enough to be called sandy. A very light soil would not be injured by packing, or helped, perhaps, by replowing. Late years, whenever I wanted to do my best, my old tools were used. Since knowing the difference, however, I have planted mostly with the planter. It is so easy! It is hard to go back. I have sometimes felt as though I had rather take 25 or 40 bushels less per acre than get help to drop again; but, of course, that is not business. Again, in a real dry spring, with my land quite dry, it does not make so much difference. If nothing happens to prevent, we intend to plant our entire crop by hand this year.

For years I kept this matter to myself. I feared I was mistaken. This winter I have met some other growers who were of the same mind. The Aspinwall people will, of course, change their wedge marker to a plow, when it is made certain that it would be better. There is no patent on my marker and coverer. They are not made for sale. I got one up for my own use, to do exactly what experience said was best.

You will notice all through, that we try to avoid unnecessary packing of potato land when plowing, when harrowing,

and when planting. Firmly packed soil is not best. Work when dry, plant when dry, as far as you can. Weeks of heavy rain, as we had last season, do injury that mortal man can not correct, by packing the soil so solidly. The only remedy in such a time is prevention in the shape of light soil very full of vegetable matter. Then you can smile at the rain.

Wife says, "Explain more fully why you intend to plant by hand this year. You know it is not *all* on account of your marker doing better, as a hasty reader might think from what you say."

Very true. My seed will cost me more than two dollars a bushel on account of buying Northern grown. I can get along with perhaps a bushel less per acre, by hand-planting, and I intend to drop my Freeman seed 16 inches apart in the drills. When the planter makes a miss, set to drop every 16 inches, it would be more serious than when dropping every 13 inches; 32 inches would make quite a break—more than I want to see. It will take no more time to mark and cover with my tools than to plant with planter. The only difference in expense will be about $1.00 an acre that the dropping will cost. To offset this, if I get good droppers there is the saving of seed; gain from extra tillage, which doesn't cost me a cent; more perfect stand, and the enjoyment of doing one's best. Now you have the whole matter before you, and just as fairly as I can put it.

When I read of Mr. Hummel's yield with fertilizers of 350 bushels per acre, as told of in another chapter, and that he planted with a planter like mine, I felt that any reader of this chapter would say, "Well, that is good enough. I guess the planter is as good as any thing." Then I noticed more particularly, and found his soil was *light* and *sandy*.

There is consolation in this chapter for the small careful grower who can not afford a planter. Very large fields will always be put in with the machine, doubtless; but we may get the machine improved.

CHAPTER VIII.

What Varieties shall We Raise?

You will notice that, in the first seven chapters, we have considered every point connected with preparing the land and planting the crop. We are now ready for the seed. In this and the three following chapters we will write of varieties, selection, and treatment of seed, cutting of it, etc. The best variety for one to grow depends on several circumstances. If for early market, you want very early ones—this for the gardener with a home demand, or for growers who want to ship to more northern markets. If to get off in time for wheat, but not for the earliest market (what we are doing), the medium early varieties, such as Beauty of Hebron, New Queen, and others ripening at about the time they do, will be best in this latitude. They can be gotten off in good season for wheat, and, as a rule, will yield better than extra early varieties, under similar conditions. If planted in this locality these medium early ones put in quite early will make a crop before summer drouth gets very severe, as a rule. If you live in a region where winter wheat is not grown, and you are in no hurry about getting them off, and they can as well as not have more time to grow, varieties ripening later, such as the Monroe Seedling, Empire State, Rural New-Yorker No. 2, etc., may be the proper ones for you to plant.

You need first to decide on your regular system or plan of work, and then choose accordingly. I have grown thousands of bushels of the Monroe Seedling potatoes, and got them off in reasonable time for wheat, and they are a medium late potato; but it is too close work, and we propose to keep in the medium-early line in the future.

Now, perhaps, from the title you expected to find out the

name of the varieties you had better plant. But this I do not propose to tell you. In fact, I do not know. The same potato varies greatly in different localities. For ten years, perhaps, the Hebron did us grand service. We could find nothing as good for some years. But I have sent some to good growers, who were induced to try it again because it did so well for us, and they have reported that it failed miserably, as usual, with them. It has been a standard variety, succeeding well quite generally; but, you see, with notable exceptions. With varieties not as reliable, there would be much more variation in returns. I have sent potatoes which yielded 300 bushels per acre with me, to parties who never got one-third that yield, although other kinds in the same lot gave large crops. These are undoubted facts, and one had better be slow about going largely into untried varieties. The Monroe Seedling potatoes were very satisfactory with me; but in Southern Ohio I find, as a rule, they are a poor yielder, while in Western New York they do finely. Try promising new varieties in a moderate way, and find what is best; and don't depend too much on the yield of one year. A different season may give very different results. Again, some new kinds soon dwindle out. I do not feel entirely certain about any new variety until I have grown it three years at least. Be honest with the old kinds when you test something new side by side with them. See that they are side by side, and treated exactly alike. How natural to give the new kind the best place and extra care! The same attention might make your old variety surprise you.

I would not be understood as saying you never need any thing new, or that your potatoes will not "run out" in time, with the attention at least that it is practical to give them. I know they will; so don't hold on to them too long. As we manage, at least, we need new blood from time to time. It seems to me that getting seed of the same variety from a locality more favorable for the perfect growth of potatoes is for a time equal to getting a new variety. Good potato soil

in the far North is, of course, the place where the potato does its best. There are places where 400 bushels per acre are as easily obtained as 250 are here. I have practiced changing seed in this way:

When the Hebron began to decline I sent to Northern Maine and got my seed. Seed has also been bought in New York State, in a good section. This year I have 20 barrels, now in the cellar, of J. M. Smith, of Green Bay, Wisconsin. They cost me $110, besides freight. I preferred to buy them rather than to plant my own seed, as our season was not as favorable here last year. There was no change made in varieties. They are the same that we had many of last year.

There are some varieties of potatoes that may be forced up to a higher yield per acre than others, that may be of great value for high farming on rich soil, and worth little on poor land. The Freeman, which has lately been introduced, is one of these kinds, I now think. It will stand and pay for much forcing; but if you want to plant on white-bean land I think I could name a coarse rank grower that would stand the treatment much better. And that reminds me of another point—quality.

As a rule, varieties of inferior quality are large yielders, and the kinds of high eating quality are not the most productive—at least, under ordinary conditions. You must select quality to suit your trade. In the fall and winter, the late varieties, of rather inferior quality, sell in large markets, by the car, at top quotations. Let them have what they want. To retail customers I would furnish a higher quality, and show them the difference and get a better price. It can be done when people find out the difference between a Snowflake, Hebron, or Freeman, and a Burbank or White Star. Plenty do not know, and still much will depend on the way they are grown. Don't grow too many varieties. Folks say to me, "I suppose you grow a great many kinds." No, that is not business—not for market. We have rarely grown more than two varieties. We shall grow but one this year.

To sell in market you want a kind that is known and in demand. In our markets, almost all early potatoes except Early Ohio sell as Rose or Hebron. Every thing that at all resembles them goes under that head. All long white potatoes in the fall are Burbank.

Is it possible to so select seed and care for a variety that it will not run out? J. M. Smith thinks so. He has had the Early Ohio for many years, and thinks it improving rather than otherwise. I had a talk with him about this but a few days ago. Northern latitude, rich soil, and a splendid cultivator are giving their legitimate returns. Another friend, T. Greiner, of La Salle, N. Y., thinks that his Ohios are improving. Mr. Carman, of the *Rural New-Yorker*, thinks potatoes may be so managed as not to run out. Against such authorities my opinion has little weight; but I must think that, if they live long enough, the Early Ohio will be a potato of the past with them. Ten years ago I thought that, by selection, I could keep my Early Rose from running out. They were kept up a long time; but I had to change my mind. I believe we can keep up corn by selection. It is the seed of the plant. Potatoes are not the seed. I know they can be improved, and kept up longer by what man can do.

This book earnestly advises doing what we reasonably can to keep varieties up. They certainly run out much sooner than they need to.

CHAPTER IX.

Selection and Care of Seed.

My usual practice has been to use for seed, only nice, smooth, perfect-shaped, well-matured tubers, in size varying from medium to large. Very large overgrown ones, and those that have prongs on, or are otherwise ill shaped, are carefully excluded. In short, I use for seed just such potatoes as I should like to have the crop all be in the fall. The best time to select these is at digging time, when they are first thrown out of the ground. I have even gone so far as to follow the digger, and select the best potatoes from the best hills—hills perhaps where the yield would be double the average of the piece. With this much care in the selection of seed one need not be as much troubled about his seed running out. It certainly will not run out as quickly. Some good authorities think it would never deteriorate, as I have told you. What farmer would think of sowing his wheat-screenings for seed, or planting the corn from the poorest ears he could find? Not one. They select their best corn, or, at least, a good average, and sow good wheat, or clean it up and sow the best. Why not do as well by the potatoes? But how many there are who do not? The low average yield of our potato crop, considerably less than 100 bushels per acre, is a disgrace, and there are many causes for it; but perhaps no one cause is more certain than the selling and eating of all the best and planting the culls, which are fit only for pigs. But thousands do just this. With many farmers, "seed potatoes" means small ones. I have had them come here and ask if I had any, and write for them; but I think there are fewer and fewer each year planting such "seed." I know the tubers are not the true seed, and on this account it has been claimed that it makes no differ-

ence; but I know it does—yes, I *know*. Like begets like, to a greater or less degree, although not always directly. As a man sows, so shall he reap, has no footnote making an exception of small-potato planting. With such "seed" the variety will run out sooner, and yield less meanwhile, as a rule. Under very favorable circumstances there might be no difference in a single year. But no man on earth has better seed than my oft quoted friend J. M. Smith. On account of scarcity of a certain variety, he planted last spring about two acres with small potatoes (not very small), properly cut, of his own growing, side by side with large seed cut fine. Result, 25 bushels per acre less; smaller average size; and this on rich land averaging 300 bushels per acre, and with perfect cultivation. I tried some small potatoes whole last year with worse results. Careful experiments settled this matter for me many years ago. I tried it over last year only from lack of better seed. Little potatoes — littler, weaker eyes; littler, weaker plants; a poorer start, a poorer pocketbook in the end, every time. Notice, I say, "in the end." I would be understood as saying the tendency, as a rule, is toward deterioration. There may be exceptions. If you should plant a whole small potato and only one stalk grew up from it, it might be as good a hill as you would get from a one-eye piece from a large fine tuber. Yes, under some circumstances it might be better. But as a rule we get several sprouts from the small tuber, and hence smaller potatoes, and not as fine, as from one good stalk from one good eye. If we cut the small potato, then we get such a weak plant from the small eye, and little piece to feed it, that we are behind again. But more will be said on this point in the chapter on cutting seed.

Selecting the best seed from the best hills at digging-time paid me. I would still do it; but we use a digger now. When we dug with forks it was practical: it is not so now. The best we can do now is to select the best part of the field and pick out the best potatoes from that place. This is bet-

ter than to take from the bin, and far better than to take the culls after all the best have been selected out. Again, the small grower, who can not afford machinery, you see, has an advantage, if he will do his best. I am glad to bring out these points.

Care of Seed.

After being picked out, the tubers for seed may be carefully taken to the cellar, without the sun being allowed to shine on them, and stored in barrels. These barrels should be covered with old carpets, and then every care taken to keep the cellar as near the freezing-point as possible, and not have the potatoes actually freeze, from the day they are put in till they are taken out to plant. By taking care to open the cellar cool nights, and shut it up tight during warm days, one can keep it quite cool in the fall After cold weather comes, keep a thermometer in the cellar, and open up and let in cold air whenever the temperature inside gets above 35° or 36°. Do not be afraid of freezing the potatoes; for if they are in barrels, and covered up, you can safely let the thermometer fall to 28° for a short time. You know potatoes do not freeze as easily as water. But when the thermometer gets to freezing, you had better take down a kettle of coals, or light your oil-stove, and let it burn till the mercury gets up to 33°. I should like to keep the temperature between 33° and 34°, if possible, all winter, and I have gone to a good deal of trouble to try to keep it so. The object is, of course, to keep the tubers from sprouting. At the same time, your apples and other vegetables will keep much the better for this low temperature.

Of course, you know your cellar and you will not run any risk from keeping it so cold that it will freeze during a cold night. We see it stated that potatoes will be injured for seed if kept colder than about 40°. Well, I know just what I am writing about, as I have kept hundreds and hundreds of bushels below 35° for months at a time, and they grew per-

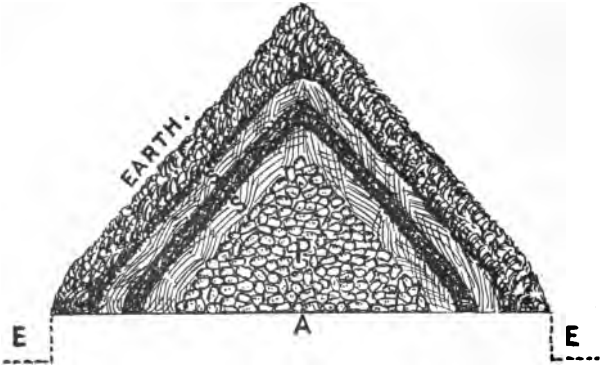
fectly. I wish I had a dollar for every time I ever went down cellar to see to the temperature. It was, often, a number of times per day. The barrels with seed in should be set up off the bottom of the cellar a few inches, on strips, so cold air can pass under them. Use tight barrels, and cover from the air all you can. The tubers should be entirely dry and cool when put away. I would not move them till ready to plant. I have tried handling and shoveling over to prevent sprouting, on hundreds of bushels. I would not do it again. It injures the sprout and often causes it to throw out side shoots. These are not as good as a new sprout from the eye direct. So, don't move seed. Keep it from sprouting if possible; but if they do sprout, let them alone until ready to plant; then break the sprouts off close down and let new ones grow. If you could spread the seed out thinly, in the light, thus causing sprouts to grow tough and stocky, and then cut carefully and plant by hand, not breaking off the sprouts, this would do. But the machine will break off the sprouts, even under these circumstances. There is some gain to the early gardener by the above plan of sprouting. They come up quicker. In our field culture in this latitude we do not want to hurry them.

Burying Seed.

For several years I have, I know, kept my seed better by burying it. This for Northern Ohio. It would not be as practical 300 miles south. It may not be needed 300 miles north. We had quite a heated discussion over this point at the great Wisconsin round-up institute, on "Potato day." It was a convention of the shrewdest growers in the State. Some claimed they could do better in that climate to keep seed in the cellar. Very likely. The cold comes sooner and lasts longer than here. The trouble here is during the last month or so before planting-time. We can not always keep early potatoes cold enough to keep sprouts back. A cold-storage building would be the perfect place for keeping them,

where ice could be used in the fall and spring. Quite likely I should have built one before this, if I had been at home winters instead of away attending farmers' institutes. I should enjoy being able to keep seed *perfectly, every time.*

But now about burying the seed. As we dig early to put in wheat, we put potatoes on the bottom of a cool deep cellar first, as it is cooler there than they would be if buried at that time. When the earth gets cooler than the cellar, early in November, we select a dry place to bury, where no water will stand. Better if it is on the north side of buildings, or hedge, or trees, so it will not thaw as readily when the south



Cross-section of my seed-potato pile when finished for winter. P, potatoes; S, S, straw; E, E, where we took earth for covering; A, surface of ground.

wind blows. We draw out on a cold morning, when cloudy and near freezing. The ground is then cold, and we can cool off the potatoes. I should like to have a cold wind blowing. We put them in a long narrow pile. For 100 bushels we make the pile about 30 feet long and 4 feet wide, and pile up as high as possible on this base. Pile right on top of the ground, not in a trench (see cut). Then we put over a good layer of forkfuls of straw, laying around the base

first, and then above, and lapping over, and finally "topping out" with a layer of forkfuls. The object is, to put the straw on so as to shed water. We have always accomplished this without covering the pile with boards. Then we put about four inches of earth over the straw. This earth should be taken out 2½ feet back from the base of the potato pile, all around, leaving this base to build the cover on. I mark out, right around, with a line, and cut it down with an old ax. When this earth (4 inches) is frozen partly, and before there is any risk of a heavy freeze, we put on another layer of straw, in the same way as at first, and then some ten or twelve inches of earth. Care is taken not to cover any more than enough at the base, so as to make the pile steep enough to shed water well. We top out well with earth; pat down the sides smoothly with shovel, then don't think any more about it till some cold day, say in the latter part of February, when the pile is bare of snow and the ground frozen solid (clean off snow and let it freeze if necessary). Then draw out a big lot of straw, or clover haulm is better, if you have it, and cover the pile all over, and 4 feet out all around, deeply, two feet at least. This will keep the frost in. Sun and wind can not get at it. Rains will wet the straw, and then dry out before another storm. The other day, when wife and I were out walking about the farm, without any wraps, it was quite warm, and the frost was all out of the earth, and the ground was well settled. I ran my hand down through the straw on the potato pile, and the earth on the under side was as hard as the day we put it on —not thawed the least particle. You see the point—get the potatoes cold as soon as possible, and keep them so. Mulching will keep frost in till into April. This is less work than so much attention to the cellar, with me; and for several years, with the exception of one warm winter, we have had perfect success. That winter we did as well as we could in the cellar, or better, perhaps. No ventilation whatever is given the pile. The first years we put in tile ventilators

every few feet. They are of no earthly use for dry, cool potatoes, dug weeks before and taken from the cellar to the pile. They might be, if potatoes were freshly dug. About that I do not know.

Notice the two dead-air spaces, made by using two layers of straw and two of earth. This makes the protection from cold and from changes of temperature much greater. Put up as I have described, with perhaps a little heavier covering in colder latitudes, I should feel entirely safe from frost in an unusually cold winter, and from too much covering for a warm winter. We hear of this objection. I do not think there is any thing in it. Cover enough. Then if the pile is in proper shape, and potatoes in right condition when put out, and earth ditto, deep covering can do no injury in a warm winter.

After putting on the first covering of earth, you can spread some chaff around the base of the pile to prevent the earth that you want to use for a second covering from freezing; otherwise, some cold day, when you *must* finish covering, to protect the potatoes, you might find hard shoveling.

This selection and care of seed is a good deal of trouble; but the time seems to have passed when we can raise a large and paying crop of potatoes or any thing else without trouble. I have heard old men tell of planting a field and plowing it out only once, perhaps, and in the fall they could kick out the potatoes, 400 or 500 bushels per acre. We can't do it now, and I think these old farmers must have had pretty long chains and small baskets to measure with. One of these men, who bragged of having raised some 500 bushels per acre, once came across my lot when we were digging a load of Early Rose potatoes. He stood silently by for some time, but at last exclaimed, "That beats any thing I ever saw in the way of potato yield!" They were turning out not quite two bushels per square rod, or at the rate of 300 bushels per acre. An acre of potatoes yielding 500 bushels is a sight not often seen in this locality. I have dug small

patches that yielded at that rate, but never a whole acre. I would go a long way to see such an acre. But, to return to our subject:

Why all this great care to keep our seed potatoes from sprouting? There has not been any thing said about this. We have tried to explain why good tubers should be used. Well, the first sprout that starts from the eye of a potato is the strongest and thriftiest one. If it is allowed to grow in a warm cellar, and is broken off at planting-time, the eye will usually throw out two or more sprouts the second time, smaller and weaker; and the result, particularly under unfavorable conditions of soil and season, will be too many stalks in a hill, and weaker vines and smaller tubers. If the seed is sprouted twice, the third sprouts which start will be still more numerous and more feeble. All this, of course, is as a general rule. Did you ever stop to think why the Creator arranged this so? Well, there is a natural law, of course. In a piece of potato there is only just so much nutriment for a sprout to use. It takes some to grow the first one. There is less for the second, and far less for each one when it is divided between the two or three sprouts that usually start. But why was the eye made to start more than the one first sprout? Why, it wouldn't do to arrange so that careless farmers would lose their seed entirely. They might literally starve. So the second sprout is to help such out, but is weaker, so as to punish them for not tending to their business. The Creator gave man dominion, and he reaps just exactly according as he takes it, as a rule.

Of course, you always remember that very favorable conditions of soil and season may overbalance poor seed. A man may even plant small potatoes that have sprouted badly, in a very rich garden soil, and, with favorable weather and good care, gather a bountiful harvest. On the average he has done very well. The same experiment in a poor season, made side by side with good seed, might show very different results. With strong healthy plants from good seed,

and with favorable conditions of soil which we *can* control, we may be able to raise a good crop in spite of unfavorable weather which we can *not* control.

Years ago, one warm winter we were unable to keep our seed in the cellar from sprouting considerably. They were early potatoes. I well knew the risk of planting such seed, and, early in the spring, I sent to the Northeast and secured seed that would not sprout before we could get it here and in the ground. But I did not send for enough. It was quite an expense. The season might be so favorable that it would make little difference. Well, when we planted the last six-acre field our imported seed ran out about in the middle, so half was planted with our sprouted seed. The season was dry instead of favorable. All summer it was easy to see where we had made a mistake. In the fall we had about an even hundred dollars less from the three acres where our sprouted seed was used. There was no difference in conditions, except that the change of seed might have had something to do with the result. My impression is, it was largely the condition of the seed. The conclusions in this book are founded on numerous actual experiences such as this, in every line, which are seldom given, as it would greatly increase the size, without doing the working farmer, for whom it is written, any good.

Since the above was written we have opened our seed-pile and taken out part of them. Last fall we drove stakes down and laid boards, 6 inches wide, up against them, on edge, 4 feet apart, to pile our potatoes in between. We think it an improvement. It is easier to get them out, and less trouble to build the pile. This has been a very cold winter, and I was anxious to know whether our pile was all right before this book went to the printer. The outside layer of earth is frozen now (Apr. 1), solid. We had to chop it into blocks with an ax and then turn these over by use of a bar to get in. The under layer of earth was frozen way through, solidly, on the west side, and partly on the east. If it had not

been opened I doubt whether all frost would have been gone by May 15. But the pile was very solidly frozen when covered. It was very cold weather. Not one single tuber could we find that was touched with frost.

In a former chapter mention was made of buying 20 barrels of seed this year for my own planting, that were grown in Green Bay, Wisconsin. I bought them and paid for them; but since then, at the urgent solicitation of a friend, I have let him have 10 barrels of them, and in their place we will plant five acres or so with small potatoes, which we have in our pile. We will cut off the seed end and throw it away, and split the rest of the potato into two pieces, lengthwise probably. We preferred to pay $55 for 10 barrels of good seed, and the freight, rather than to use these good small ones we had, that would cost us nothing. We did not wish to make the change, but still we may not lose by it, on account of the high price of good seed. This explanation is made that you may know why we, for the first time in many years, will risk inferior seed. We were under many obligations to the friend in question, and I do not know where any more good seed of the same variety can be obtained.

Some are getting seed potatoes from the South instead of the North. They are called second-crop seed. Potatoes of the first crop are planted after they get ripe, and another crop is grown that fall quite late. These, of course, will keep over the winter in pretty good condition. I have known them to be left in the ground all winter, and then dug in the spring. It is claimed these make as good seed as Northern-grown first-crop potatoes. I should prefer the latter, if not sprouted at all; and still I have had large yields from the southern second-crop seed. As far as my experience goes, the quality of the crop from the northern seed is rather better than that from the other. It is claimed that the southern seed gives an earlier crop; but I failed to see any particular difference. Perhaps if digging for early

market, before they were ripe, there might be some gain. I judged by the time the vines died down.

Wife suggests that I should tell the object of making a seed-pile long and narrow instead of round and large, as is the more common custom. It is, that they may cool through quicker and be kept cooler. The center of a pile is nearer to the outside, and the outside cold can work in under the pile more, and still, with the protection given, they can not freeze.

I may tell you another thing right here that will help you some time. Mr. Smith sent me the ten barrels of seed about April 1. If I put them in my cellar they would sprout before we could plant. Looking out ahead, I covered the freezing-cold earth, a square rod of it, with straw some three feet deep, in March. When the potatoes came we moved the straw, placed the barrels on the almost ice-cold ground, and covered deeply with straw again. I have since opened them, on a cold morning, and found the temperature of the potatoes to be 36°, and no advance in sprouting. "Where there is a will there is a way."

CHAPTER X.

Prevention of Scab.

Suppose, now, you have selected fine tubers for seed, and have kept them perfectly, so not an eye has started a sprout. There may be here and there spots of what is called scab on them. This is very common now. Or perhaps there were more or less scabby potatoes in your crop the year before, from which your smooth seed was selected. Or, again, you may be so unfortunate as to have nothing but scabby seed, and badly scabby too. You may have some new and costly variety that has scab on, and still you want to use them for seed. In all these cases, what you want to know is, will these potatoes do as well for seed, or does that law of "like begets like" hold good in planting scabby potatoes? It does, according to our best present knowledge. It is only very recently that we have seemed to get any real light on this point. What we know now, or think we do, is not, perhaps, absolutely a settled fact. Some among our scientific authorities still dispute it; but I feel quite certain that Prof. H. L. Bolley, of North Dakota Experiment Station, is correct in his conclusions, that the first cause of deep scab is a plant organism, of very minute character, which attacks the surface of the young growing tubers, eroding, irritating, and blackening the adjacent tissues—a sort of "bacterioid fungus-like affair." This would seem certain, because pure masses of the scab-plant, grown on nutrient gelatin, free from all other germs, when transferred to the surface of healthy growing potato-tubers, will invariably produce the disease at the point of application.

Knowing this much you will readily see that scabby seed will, under ordinary circumstances, produce a scabby crop. As it is a germ disease, if you selected smooth potatoes out

of a scabby crop, or handled all in the same boxes, you may possibly and even likely have got the disease germs on your selected tubers. Again, another thing has been learned: The disease will remain in soil where once it has been. How long, we do not know. That it will stay, all ready for business, three years, I know. The fungus, as we will call it, lives along, waiting for more potatoes to work on. Now, don't you see what we practically want? First, something that will kill those germs on the seed, if any are present; and, second, something to end the germs in the soil when these are troubling us. Sometimes these germs in the soil do not come from raising potatoes directly. They certainly originate in some other way. The tendency will be toward getting them in the soil by continuous growing of the crop on the same land. There is less danger of all such troubles where regular rotation is practiced. But we once cleared off some timber, grubbed out the stumps, and put in potatoes without any manure, and on one place the first crop was scabby, and every succeeding one has been, no matter how nice seed was put in. Two years ago we plowed up land where we had grubbed out an old orchard. It had certainly had no potatoes on it for forty years; but on part of the land they were horribly scabby. How did the disease get there? Well, it is easy enough to think how it might. Some cow might have been fed parings of scabby potatoes, and left her manure in these places. I simply give you this as a hint of how much trouble we may be put to in the future by this fungus. By feeding potatoes to our stock we may fill the manure with the germs, and then scatter it over our land. As stated in another chapter, fresh manure is more likely to cause an increase of scab than old rotten manure. I have a strong impression that horse manure is worse than cow manure. But on most of these points we are yet in the dark. We have no certain known way yet of destroying germs that are in the soil. I have met a number of growers who have faith in the use of lime for this purpose. Years

ago, Prof. M. C. Reed, of this place, then State Geologist, told me that, in his garden, where potatoes had been grown so long that it was full of the disease, liming the soil for two or three years, and using only smooth seed, he got rid of the trouble. I have seen no account of long-continued and careful experiments that prove this. But Prof. Bolley has shown pretty conclusively that the germs on the seed may be destroyed. This, of course, is a much simpler matter, as we can get directly at them.

Killing Germs on Scabby Potatoes.

I will now tell you what I know about this. You remember my telling of growing some horribly scabby potatoes in my orchard lot two years ago. I expected something fine there. I had planted a new and high-priced variety—very high. I could not afford to lose them. To replace them I should have to pay some $12 or $15 a barrel. I had heard of Prof. Bolley's experiments in this line. Director Thorne, of our Experiment Station, kindly obtained reports for me, and Prof. Bolley as kindly advised me by private letter on points about which I was in doubt. The result was, that I treated some forty bushels or more of these awfully scabby tubers, according to directions, and obtained a smooth crop —made the seed as good as though it were smooth, by killing the fungus growth that was on it. I worked with some little fear, because, if I failed, I should fill some five or six acres of soil with the disease. Of course, the seed was planted in land that had never produced any scabby tubers to speak of. Otherwise it would have been of no use to treat the seed.

We first picked out three good tight flour-barrels, and soaked them up until they failed to absorb any more water. Then while these were soaking I went to a druggist and bought seven packages of corrosive sublimate (mercuric bichloride), two ounces in each package. This he pulverized finely in a mortar before putting it up. Next I bought three

CUT SHOWING POTATOES NOT TREATED WITH THE [redacted] MIXTURE.

CUT SHOWING POTATOES FROM THE SAME FIELD AS ABOVE, WHICH WERE TREATED WITH THE [redacted] MIXTURE TO PREVENT SCAB.

The above cuts were kindly loaned us by Prof. H. L. Bolley, of the North Dakota Experiment Station at Fargo, N. D. A full report of these experiments will be found in the Bulletin for December, 1891.

wooden-pulp pails (common wooden pails would do, but they would absorb poison. Crocks would do; but no metallic vessels should be used). Coming home I put two gallons of hot water in each pail, and a two-ounce paper of the sublimate in each one. This I stirred with great care until dissolved (in the evening), and let it stand until morning. Then we put 13 gallons of water in each of the three barrels, and emptied into each one a pail of the sublimate solution. This was allowed to stand in barrels some four hours, being thoroughly stirred often. Meanwhile we got out the potatoes, putting a bushel at a time into a wash-tub, and washing them with our hands through two waters, to get off all earth, and clean out scab holes as much as possible, so poison would be sure to reach all points. Having the potatoes washed clean, enough to fill the three barrels, we put them into the solution, and let them stay one hour and thirty minutes. Meanwhile we washed some more. At the end of the 90 minutes we put a potato-box cover (just a plain board large enough to cover the top) over one barrel, tied a rope around under the barrel and over the cover; put in a stick and twisted it up, to hold the cover tightly, but leaving it open on one edge about an inch. Then two of us tipped the barrel over quickly on the edge of a large wash-tub, and poured out the poisoned water. We then emptied out the potatoes, put in fresh ones again, and poured the water back in from the tub, and so on with other barrels. We used the same water but three times; but we see no reason why it could not be used until worn out. It would be poison as long as any remained.

All this was no small job, because the sublimate is a powerful poison. I just stood over the barrels and pails with all my wits about me to see that there was no carelessness. There is no danger from the poison if you do not get it into your mouth; therefore I saw that every mouth was shut when we were pouring it. It would do no harm to a cut finger. This is the same strength of solution that is used in

surgery, one part to a thousand of water. If you should cut yourself when cutting poisoned potatoes, it would help the cut to heal instead of doing harm. But be exceedingly careful with the dry sublimate, and that no treated potatoes are eaten by man or animal. I was greatly relieved when the last of the poisoned water was emptied on bare ground (not grass), far from any well or spring, and the last tuber was in the ground.

This was work enough; but really our troubles had but begun. When the tubers had been treated, what were we to do with them? We could not safely put them in any thing that had had potatoes in before, you see, because the germs are microscopic, and we might get some back on. We did put them on the grass in the dooryard, and covered them—with our canvas covers, or old carpets we use for such purposes? Not much. Danger of germs, again. We actually had to get some sheets and old blankets from the house. Then we cut the seed right there, after scalding the knives and pans we used, and put the cut seed into some new grain-bags that had never been used, as the only perfectly safe thing we had. For dropping by hand we used the poisoned pails. We were just about to put some seed into the planter when we thought in time, and thoroughly cleaned it out with boiling water first. Some of the best of the seed, washed but not treated, gave us a product about as bad as the seed. Always treat seed before cutting.

This is but a single experiment, but agrees with several by Prof. Bolley. Without extreme care, you can see an experiment in this line would be of no use. There was no injury to the sprouts of the potatoes. I tried it on some that were started.

The question is often asked, whether the scab can continue to increase after the crop ripens. I do not know; but from what I can learn I think not to any extent. Prof. Bolley applied the germs to a growing potato in the form of a letter L, and they did not extend much, but showed about the

same L on the ripe potato. He says we must bear in mind the effort always made by a living tissue to heal a wound, in order to understand the form the scabs assume. The ultimate form is the result of a continuous formation of layers of cork below the area of disease, because of the irritating, eroding action of the parasite. It seems as though this action must stop as soon as growth is over. If so, some growers are greatly mistaken. For example, one market-gardener told me he always dug his Early Ohio potatoes the moment they were done growing, as, if left in the soil till fall, they would be a mass of scabs.

Later.—I have just got from friend Root 25 *new* bushel boxes to handle my seed in this year, after treating it. I think it will be advisable to go to the trouble of treating it. There may be some germs on my own or purchased seed, no matter how nice the tubers may look. I have just bought 12 oz. of corrosive sublimate also, for $1.50.

CHAPTER XI.

Cutting Seed.

Shall we cut it, or shall we plant whole? shall we cut in halves, quarters, two-eye pieces, or one-eye? Some say one way is all right, and others say that is wrong and theirs is right. Experiment stations say one thing and practical growers another, perhaps. What shall we do, any way?

Well, friends, this matter does seem to be pretty badly mixed up. Let us try to explain it a little. Perhaps all these good people, with so many different minds, are right. Didn't you ever think of that? Truly it is simply a matter of conditions and skill—that is all. Well, no—not quite; variety has a little to do with it. If you have poor land and rather poorly prepared and small seed that has sprouted, you would be right, perhaps, in planting whole potatoes. If you are two or three steps higher up, and have pretty fair soil and seed, and tend to the crop moderately well, a quarter of a potato, or possibly two or three eyes on a piece, may about suit you. You may find it as well as to use more seed. Or, perhaps, the whole potatoes, if not too near together, and if you do not grow for market, may still give you more bushels, big and little. But if you have rich land and good seed, and make a business of growing them, and tend to it too, with most varieties one-eye pieces the proper distance apart may make you the most money. Now, isn't this simple and plain? and I think it is just about true.

There are not many men, probably, who have cut potatoes to one eye as long as has the writer. He wasn't born with the knowledge that that was the best way for him, but rather happened on to it at first, and then went to thinking and studying over it and all the points connected with it, and experimenting. When he found there was something in it,

he began to tell others about it. At first we were laughed at and pitied for our greenness by many, the same as when we began haying a month before the rest, and had dried grass instead of hay that we must feed with grain. But we had studied arithmetic, and had a little common sense, and were able to figure out that we were on the right track, and went right along. In due time our turn came for a great big laugh. We have lived to see people, who once honestly pitied us, plant large fields in the same way.

My first experience was with the Early Goodrich, I think; then, soon after, with the Early Rose. The seed cost a high price, and we cut it very fine, and gave the best of care. The result was a surprise in several ways. For example, we cut the Rose down to one-eye pieces, mostly. Toward the last, however, as the seed more than held out to plant the piece we had prepared, we planted one row with quarters, one with halves, and one with whole tubers, but not very large. Now, of course the last row made the greatest show at first, and the one-eye rows the poorest. Every one who looked at the piece, myself among the rest, judged the yield would be according to the growth early in the season. I was pretty green then, some 23 years ago. Well, at digging-time didn't we have some beauties where the one-eye seed was used? I picked out some that weighed two pounds each. the more seed, the smaller they were; and the yield from one-eye seed gave 25 per cent more merchantable tubers than the average of the other rows. Now, people thought that was all right enough for garden culture and a high-priced variety, cutting so fine; but how crazy they thought me when I began to carry out the same idea in field culture! A man wanted to put in a piece on shares. I furnished seed, and it was rather small too. I hadn't then learned about that. I insisted that they be cut to one eye. After planting most of the piece with these little pieces his heart failed him, and he came and told me he was afraid it would be a failure, and begged that he might plant the rest of the piece

with whole small seed. Of course, I consented, but on condition that he would divide the land in the fall and not the potatoes, and give me my share from where the one-eye seed was used. He readily agreed to this; but at digging-time he was almost angry when I held him to his bargain. I had seen to it that the conditions for success were present for such fine seed, and the one-eye seed gave the best returns, particularly in size and uniformity.

Well, we kept at work in the same line until we had whole fields and thousands of bushels growing according to our notion. Shall I tell you about some of the first good laughs we had?

Potatoes were very low, and slow sale, folks said. About the middle of July I took a sample of large fine ones (we had no other kind), in the buggy, and wife and I drove to Akron —twelve miles. I spent all day trying to get an order for a load at 40 cts. Finally one man said if I could bring a load equal to that sample he would take them. He was suspicious. He kept the sample. When did I laugh? Why, when he saw the load, and said, "There, gentlemen" (to passersby), "is something finer than you ever saw in this market before." When a neighboring grocer came to me, not I to him, and wanted a load, when I could not possibly keep up with orders, while at no time did common potatoes sell for more than 25 cents a bushel, then did I laugh all the way home, and wife and I after I got home. Yes, we did.

Again, the Snowflake potato came around. Every one wanted them; but as ordinarily planted they grew too small. They, like the Freeman, are inclined to set too many, any way. But they were well suited to my one-eye cutting. I went to growing them largely. When I uncovered the first load on Market St., in Akron, and the grocers crowded around me, and I set my price with a little fear that I had put it too high, and quicker than a flash one man said, "I want 500 bushels; here is $50;" when another man took 1000 at 15 cts. a bushel above market price; when I had unloaded my load, and the

grocer insisted on my taking full pay and keeping the $50 as a payment on the rest, so anxious was he to get them, then did I laugh, friends, away down in my boots. It was sweet to find that I wasn't so green and silly as some had thought.

Another year, when I took my first load to a very particular grocer, but one who would pay well for an extra nice thing, 30 bushels from 16 square rods, and there were bushels of tubers that would weigh one pound each, and he gave a low whistle and exclaimed, "If those are only as nice to eat as they are to look at!" and when he would not order any more until he had tried them, and sent a mess home for dinner, you hardly see where my laugh came in, do you? I will tell you. When I got home and found the message which had flashed past me, "Bring another load of those potatoes as quick as you can." I had nearly 2000 bushels of that kind, and within three days they were all spoken for at *my price.*

When I met men drawing their potatoes back home, uneven in size, not the best quality, perhaps dirty-looking things, unable to get a bid on them, at a time when we were overworked, making two trips a day, 48 miles in all, to supply the demand, and these men would say, "Terry, you are the luckiest man I ever knew," don't you suppose I laughed? And then a feeling of pity came over me for these poor brothers; and as soon as they were out of hearing I said, "There was no luck about it." Wasn't I right?

From what I have written you will gather one advantage of this way of cutting, this light seeding. If the seed has not sprouted, few tubers in a hill; and nearly all of them, if they are not planted too close together, grow to a quite uniform large size. Of course, you understand this is with all the necessary conditions of soil, etc., present. There are almost no little ones. Some years we have not picked them up at all, there were so few. It would not pay. If large potatoes are worth $1.00 a bushel, or even 75 cents, we pick up small ones, as they will then sell for enough to pay us. They

are worth some seven or eight cents a bushel to rot on the land as a fertilizer. I should not like to hire men to pick them up to sell at 15 or 20 cents. They are not often worth that to us to feed out.

With this fine cutting there is quite a saving of seed to start with. This will be of little account to a farmer growing only enough for his own use; but to a large grower it is worth looking after. The amount varies some with varieties, as some have more eyes than others, and the size of the tubers makes a difference; but say seven bushels of average seed will plant an acre in drills. If you cut two eyes on a piece it would make about 84 bushels difference this spring in the amount of seed required for my field. At a dollar a bushel, or even 50 cents, this amounts to a nice little sum that is saved or made to start with. At what my own seed will actually cost me this year it will be nearly $200. That will pay for a little extra care; so will $50. Then the crop should have the care, any way, just the same, if two-eye pieces were used.

I told you in a former chapter of another valuable point in favor of light seeding in drills. Scattered along in the drills, a few in a place, they do not grow out of the ground as much, nor crack it open as much. They *must* be kept down in the earth, for highest quality, some distance from daylight. This way of seeding gives the best chance for this, and for nearly level culture, which is also usually best. Don't think one-eye seed was all that caused those good laughs. No, no! It was *one* good point. There were others. With a single weak link in the chain, however, the laugh might have been on the other side. Yes, even with one-eye seed, and more particularly with it, perhaps.

Let me illustrate: Years ago I was sick one spring—too sick to know or care about business. I had, perhaps, the best man to work in the potato-field that was ever on this farm. He had good seed and good soil, and horses and tools; but he planted one-eye pieces on soil a quarter prepared.

Dry weather followed, and few came up. The skill to manage was not there; or, perhaps, it was rushing hard work and lack of thought. When I got around I had the piece harrowed and sown with Hungarian grass seed. This is the only time one-eye seed has failed on my farm. How easily, from such an experience, one might decide against it! But the only trouble was, that whole seed was best suited to the potato caliber of the man at the helm, and he planted fine-cut seed.

Five years ago we decided to again test one-eye pieces side by side with two eye ones, thinking that possibly results might be different now, after growing potatoes so long on the same land. We are not trying to carry our point at all, but are always ready for the truth and the best way, even if we have some pet notions trod on. Fine large tubers were chosen and cut, and the rows planted right through the field. I confess I was a little anxious when Adam got them nearly all picked up, and kept looking over that way, from where I was digging. When he waved his hat and shouted, "Just exactly the same!" well, I couldn't help feeling just a trifle glad. We dug one row at a time, and picked them up and stood boxes on the row, so no possible mistake could occur.

When a plant comes up from these one-eye pieces, of course at first it is smaller and weaker than where large seed is used; but if it came from good seed, and is well cared for, it will make use of all the available fertility there is in the soil, and turn it into good even-sized tubers What more can you ask for? Of course, you can manure your crop with potatoes, if you want to, by using large seed and getting some extra little ones. Pretty dear manuring. It takes about 50 bushels of potatoes to give as much fertility as there is in a load of good stable manure. A ton of potatoes contains but $2.02 worth of fertility, at market rates of fertilizers. They are mostly water. But the extra food in the mother-potato may be worth a little more to the plant than stable manure, possibly, as a starter.

I have hinted that the soil must be fine where little pieces of seed are used. If it is fine it will, in the spring, nearly always be moist; then the little pieces will be safe—just as safe as whole tubers, if the soil is well enough drained, and light enough so they will not rot. In extreme cases, where ground was very dry, I have rolled right after planting, for greater safety; but I dislike to do it, as the packing of the soil is bad. The harrow will not take hold as well afterward, to kill weeds—another bad matter.

It is always safest to plant cut seed as fast as it is cut. I should prefer to have it go into the ground without drying. I never dry by rolling in land-plaster. That is no gain on my land. I have known serious failures from cutting large quantities beforehand. If we cut a few hours ahead, we put the pieces in bushel-boxes (they are cool, of course, being brought from the cellar or pile), and cover and set in a cool place. Keep from all wind and sun.

This matter of fine cutting may be carried much farther than I do, but not practically for field culture. By splitting the eyes into several pieces, and very fine culture, it is claimed, and I do not doubt it, that 42½ bushels of potatoes were once grown from a pound of seed by H. C. Pearson, of New York State, for which he received a prize of $300. I have never gone as far as this; but two years ago Mr. Wm. Henry Maule sent me a barrel of Freemans (165 pounds), which were then selling at $3.00 a pound, and asked me to grow as many as I could from them for $1.00 a bushel. We first cut the tubers into one-eye pieces. These were pretty large, as the Freeman has few eyes. Then most of these one-eye pieces were cut in two, right through the center of the eye. We planted on clover sod mostly, without any other manure, dropping a piece every 32 inches each way. We were not after yield per acre, but all that would come from that seed, with all the room each piece could use. We covered in this way 1¼ acres with the seed. They never lacked for fine tillage, much of it with hand-hooks or prong-

ed hoes. We dug 305 bushels. We knew friend Smith had a barrel too, and expected he would beat us, but he did not. He was but a few bushels behind. He grew them on less land, however. I think now, if we had cut to one eye and spread over only an acre, we should have done as well. Our soil was hardly rich enough for the half-eyes. It was a close race for life with the flea-beetle when they first came up, they were so small.

It is sometimes said that all the eyes will not grow on some varieties of potatoes. I have never found any kind where they would not, if properly cut. There may be such. We have grown in this way the Peachblow, Early Goodrich, Early Rose, Early Ohio, Clark's No. 1, New Queen, Thorburn, Burbank, White Star, Empire State, Monroe Seedling, Beauty of Hebron, and others, and in a large way. With the single exception of the Early Ohio, one eye furnished enough seed for our soil. To get a full crop of that variety we should have to use more seed or plant nearer together. It doesn't seem to suit our soil, any way. With any of the above varieties, and hand planting, missing hills are almost unknown. We certainly have had acres where there was not one; but, of course, this was from prime seed, very carefully cut. If you plant a whole potato, a part of the eyes may not grow, usually, or sometimes; but when cut so there is but one on a piece, it never forgets what it was made for, with us.

It doesn't make any great difference how you cut when one-eye pieces are wanted, only so you have about an equal quantity of pulp in each one, and the pieces are rather chunked and not too thin. The most simple way seems to be to take the tuber in your left hand, with the stem end down. Then, with a very thin-bladed knife in your other hand, you are ready to begin. You can get a little help from the cut, perhaps. If you should cut the first piece off as shown by the line at the lower left-hand side, you would have a one-eye piece. But you see it would be rather thin.

Again, this heel eye is usually a weak one. It often makes a weak plant. It is usually safer not to count this eye, but cut above the next one. Say you cut about as shown by the line on the lower right-hand side, but continuing cut right

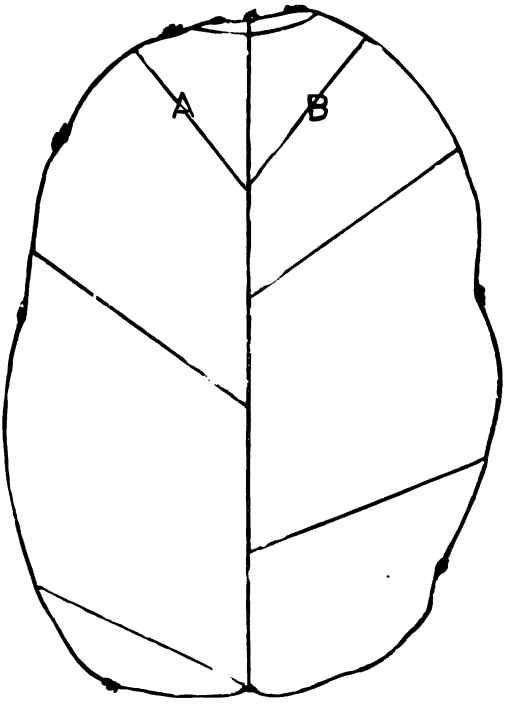


FIG. 1—HOW TO CUT TO ONE EYE.

across the tuber. Then you go on and cut the next piece with an eye on it, turning the potato as you work, and letting your knife run with about the slant shown by the side lines, taking care to get pieces about all of a size. I am

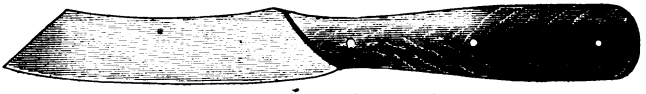
aware this is a hard matter to explain. Fig. 2, of a partially cut potato, will give you a better idea, perhaps. Now, when you get up to the top and have a piece about like that between lines A, B, left, which is about the same size as your other one-eye pieces, there will be, perhaps, a single eye by itself, sometimes two, and then a cluster of eyes. We cut off that cluster of eyes, as shown by the line, and throw it away; then that piece is as good as any. If there are two single eyes we leave them. If the cluster of eyes were left, sometimes several sprouts would start, instead of the one from a single eye, and the result would be a number of small potatoes; I have seen as many as twenty or thirty.

Now let me say, right here, that we have no iron-clad rule that every piece shall have only one eye on. Our rule is, that pieces shall be of a good fair size. Nearly always, with good-sized seed, one-eye pieces will be all right; and particularly is this true with some varieties. But you know some kinds, like the potato shown in Fig. 2, have many eyes on. In such a case, where a piece would be pretty small with but one eye on, I would cut two. Practically we seldom do this.

FIG. 2.—MANNER OF USING THE CURVED KNIFE.

The knife shown above is a patent curved-bladed one. Some like them, but I do not. We can not cut as fast as with a straight blade. The curved blade pushes hard. We tested the matter carefully, and found the pieces grew no better, although slightly more chunked. The knives we use

we got of Mr. Root. They are cheap and good, with the handle extending on to the back a little to protect the fingers. Grind them down, before beginning to cut, as thin as you dare. They will then go through the potato much easier. The back should not be much thicker than the edge. We



KNIFE FOR CUTTING POTATOES.

Price 10c; by mail, 13c. Sold by A. I. Root, Medina, Ohio.

always wind a rag around the forefinger to protect it. With such a knife, one who is used to it should cut from eight to ten bushels to one eye in a day of ten hours, and do it nicely. Of course, it will go slowly at first. A woman will usually cut faster and better than a man. They are more used to such work, and have more patience. I have seen a young lady cut a bushel an hour right along, where the seed was of good size.

If you want to cut small potatoes, Mr. L. D. Olds, of Wisconsin, who is pretty good authority, cuts off and throws away the seed end, as I do, and splits the tuber lengthwise into two or three pieces, according to size. I have cut them to one eye, but would not advise it for field culture. The pieces are too small.

The truth is, I do not want to advise at all about this matter of cutting. I have given you facts and my practice. It is so easy not to grasp the whole matter, for one not accustomed to it, that he had better be slow and careful about making radical changes, until he knows he is right, as I did, and hasn't got the wrong practice for the man and conditions. Do not understand me, friends, as hinting that you may not be as smart as I am. You may be much smarter, and still not have the experience in this line. I do not want to lead you one inch astray, but, rather, to stir you up and set you to thinking and studying and experimenting to find out the very best.

The Aspinwall Potato-Cutter.

Several letters have been received lately, asking about the Aspinwall potato-cutter, which was brought out last season. The manufacturers have kindly sent me one for examination and experiment. It will cut potatoes better than some men would, just as the planter will drop more accurately than some would. It is not perfect, but it is quite wonderful how well it will do. Where men are planting by machinery, and large areas, it will be used. If a man were planting 100 acres it is doubtful whether he would get his seed cut much better than this machine will do it. But it does not come up to real nice expert cutting. The pieces are of good shape, but vary too much in size. However, the cutting can be done much faster than by hand. At one trial I cut ten nice medium-sized Hebron potatoes. There were 30 good (except uneven in size) one-eye pieces; 16 good two-eye pieces; 13 pieces that had ¼, 1¼, or 2¼ eyes on; 4 pieces with no eyes on. Of the latter, two were stem-end pieces, and would be as well out, and would have to be picked out by hand, as the screen would not let them through. Two of the pieces, without any eyes on, were large center pieces. This is a fair average of work done. One good piece in 30 had no eye on at all. The seed end is cut off and screened out fairly well. The misses would not be a very serious matter, any more than the misses of the planter. Large growers will take the chances, doubtless, because they can cut faster. A miss of one piece in thirty means perhaps five bushels short per acre, on a 200-bushel crop. At 30 cents a bushel this would hire my seed nicely cut to one eye. But there is another more important matter to me. Those 10 tubers gave only 59 pieces that would grow. We would have made about 82 good one-eye pieces, of quite uniform size, from the same tubers. Thus the seed would go over 33 per cent farther. At a dollar a bushel this would about twice pay the cost of hand-cutting. My seed will be cut by hand, I assure you. This is all I can say about the cutter at present.

CHAPTER XII.

Cultivation.

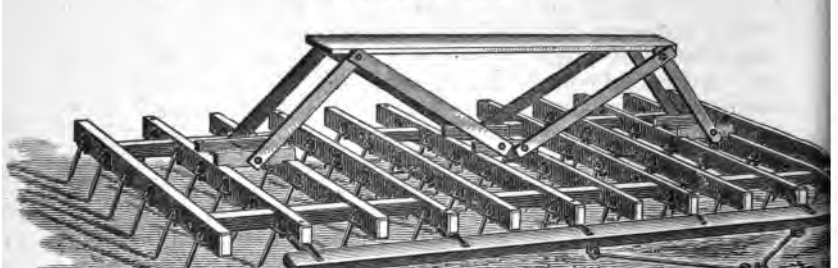
All questions connected with the putting in of the crop have now been considered. We will suppose you have the best varieties for your soil and circumstances, and the best of seed, properly cut, and planted on suitable land, all well drained, and fitted and fed in the very best way. You have done rightly so far, but you must not stop giving the crop your most thoughtful attention daily, right along, for two months or more yet. After that you may take it easy for a while, and leave the rest to Providence. But don't you trust in Providence in the slightest degree during these two months, until you have done all you can yourself. Then go to bed at night and don't worry a particle, but sleep soundly, in the full assurance that a kind Father will give you your reward in proportion to the efforts put forth. Would that I could impress on every mind the importance of spending all your energies in faithful work, and none in worrying. And still it has been a hard lesson for *us* to learn. One year it was very hot and dry. We began digging potatoes for early market; and, getting only about 90 bushels per acre, we felt pretty blue, although we got 90 cents a bushel for them. It seemed as though they would soon go down to 40 or 50 cents; and although we had never before tried so hard to do our best, we were not going to get even a fair reward. Yes, friends, I can well remember now that I thought Providence was treating us pretty hard. But how did it end? We kept on working the dry hot surface in our fields, even after we began marketing; and some sprinkles of rain came and helped us out a little. Prices advanced instead of going down, and the potatoes turned out better and better. Soon we were getting $50 a load for potatoes, or more, and going

with a load every day; and the *net profit* on the last six acres dug would have bought twice as many *acres* as the crop grew on. Actually, I did not dare tell my best friends how we were making money, because I knew they would think I was excited and exaggerating. I could tell you of many such lessons. Could I live my life over it seems now as though I would just do my best, and never worry a bit. But, friends, there is a great deal for you to do before you fold your hands and say you have done what you could; and every year we are finding more and more that we can do. Nature wants to help you; but she has her fixed laws, which she will not change one iota. She has given us brains to study out such matters; we must use them or take the consequences. Providence will never keep weeds from drinking up the moisture or eating the plant-food. She will never keep the surface of the soil stirred for you, although she has arranged so that, if you do these things for yourself, in the best way and on time, your reward shall be great.

How we Care for the Crop.

I will now tell you briefly how we care for our potatoes, beginning right after planting; then later we will talk over some of the whys and wherefores of our practice.

If the planter was used to put in the crop, the drills all show plainly, so one can cultivate as well before the potatoes come up as after; in fact, better. Going over the land so much with horses and planter has packed it pretty solidly between the rows, and so we cultivate deeply and thoroughly the first thing—tear up the soil just all we can. Within a week or so after planting, we harrow the field lengthwise with the Thomas smoothing-harrow, using two horses and taking three rows at once, and keeping horses between rows. That is, we harrow the drill between horses, and one each side. Within four or five days, say, we harrow lengthwise again; and then, after about as many more days, crosswise. It is well to drive fast, as the harrow then levels the ridges

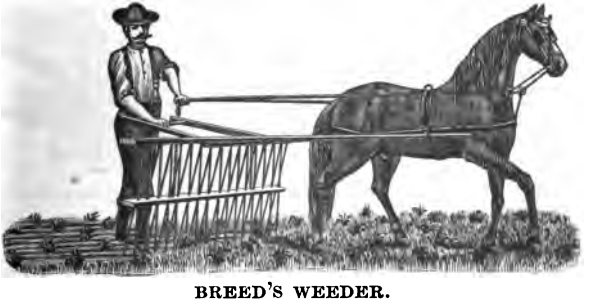


THE THOMAS SMOOTHING HARROW, WITH THE TEETH SET SLANTING.

THE THOMAS SMOOTHING-HARROW FROM THE OTHER SIDE, SHOWING THE TEETH SET STRAIGHT UP AND DOWN.

Price of the above harrow, $15.00; seat, $2.00 extra. Address all communications to the Herenden Manufacturing Co., Geneva, N. Y.

better. These three harrowings should make the surface entirely level and clean and fine. I would not ridge up much when planting with a planter. You must get the ridges, whether high or low, leveled down before the potato-sprouts get up. Look out for this. It will do to put earth *over* a sprout, but it will not do to harrow it *away* from a sprout and leave it up in the air two or three inches higher than it ought to have grown before the leaves come out. When planting by hand we harrow about the same, but we do not cultivate before they come up, as we can not follow the rows. One must be on the watch to do this harrowing at just the right time. Once in a great while he can not manage this any way, even on drained land. If a shower is likely to come in a few hours, and you harrowed only three days before, perhaps it may be best to harrow again; for, before the earth dries after the rain, the weeds may get out to daylight. The rain may continue some days. You must not take any risk, but always strive to keep the upper hand.

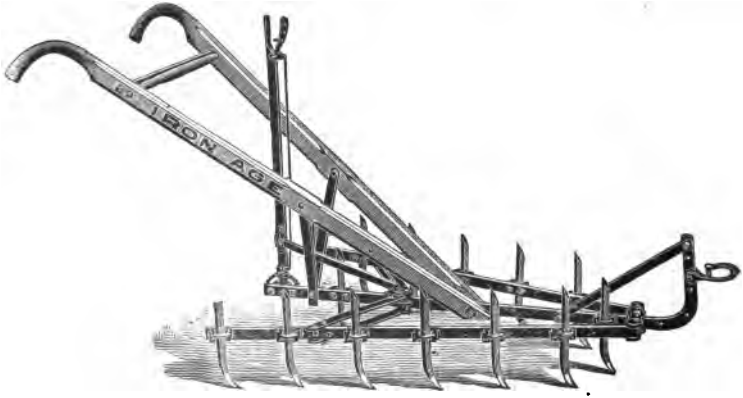


BREED'S WEEDER.

Price $10.00. Address all communications to the Universal Weeder Co., Boston, Mass.

I like to have the last harrowing done just before the plants come out in sight. Here and there one may be out, but I should like to have the great mass of them come up soon after the last harrowing.

Years ago we used the Thomas also, after the potatoes came up. Now we have a better, lighter tool for this purpose--Breed's weeder. As soon as the rows show plainly, we use this implement with one horse that walks between the rows, drawing the weeder, which, in clean mellow soil, harrows the surface lightly between the rows and in the hills or drills, two rows at a time. If the soil is packed by rain we cultivate first and follow with the weeder. The weeder is a *very* light harrow. It will not take hold of hard ground much. If we cultivate first it can, of course, take



IRON AGE COMBINED HARROW AND CULTIVATOR.

Address E. S. & F. Bateman, Kirkwood, Camden Co., N. J., for prices and all information.

hold better of the little that is left. For this early cultivation, when plants are small, we use the Iron Age cultivator with its fourteen little light teeth. You can go fast, and throw no earth. It is important that the weeder be used when the earth is just dry enough after a shower, and not too dry. There will be, perhaps, half a day when it will do its best; then the earth gets too dry. What shall you do after

that? Why, as we do—have enough weeders to go over your field on time. We have two, and can stir the surface of our field in less than five hours, if necessary.

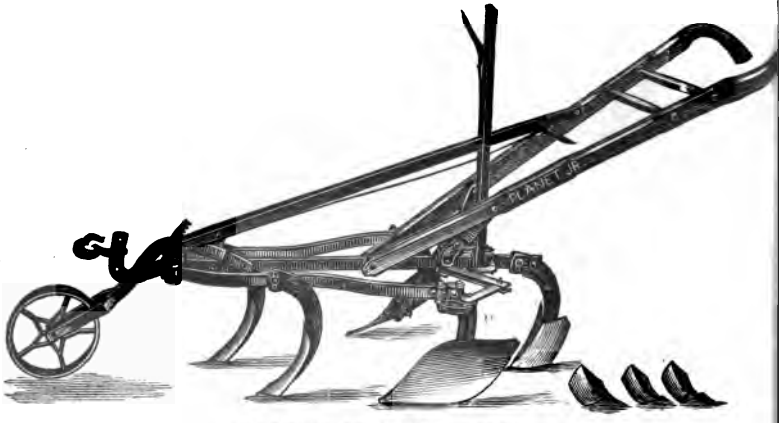
If it is cloudy, and not drying very fast, we have done this way: My son and man cultivate each with his horse and one-horse cultivator, and I follow with the weeder. As they take a row at a time, each of them, and I two at once, you see I just keep up with them, and we can go over a dozen acres in a day, and cultivate and hoe them most perfectly. We continue to use the weeder until the tops are quite large. When it pushes them over so as to do real injury, one or two teeth can be taken out over the rows, but we have not done this. We can use it about as long as it is needed, without. When the tops shade the earth under them where it can not be stirred with the cultivator, the weeder is no longer needed.

You will notice we use the cultivators in connection with the weeder, even if the latter on fine soil might do alone. One can hardly overdo this matter of tillage, and there is a great deal in having the surface fine, as well as freshly stirred. Don't you forget this. You may tear it up roughly on half a field, with cultivators having large wide teeth, and I will use these implements on the other half, that just rake the surface, leaving it fine and level, and some years, at least, I will leave you away behind. After we stop the use of the weeder we continue the cultivation, narrowing up the cultivator as the tubers begin to grow. I like the Planet Jr., with the 1½-inch steels, for this purpose.

In the cut you see the Planet Jr. as it is usually sold, with wider teeth in three places, and side-shovels on, which are used to throw a little earth in under plants. With these on it is called a horse-hoe. For simply stirring the surface after potatoes are well started I take all these 5 teeth off that are shown in the cut, and put on 5 teeth that are only 1½ inches wide. You can buy these narrow teeth as extras, and you should not think of doing without them.

About the time the tubers are beginning to form, or just

before the potato-vines begin to lop over, we have found it best to use the Planet once with side-shovels on, as in cut, throwing a little earth in under the plants, for reasons given in a former chapter. For this purpose we go twice in a row. All other cultivation is done only once in a row. The rows are so straight that we do almost perfect work on each side at once. Now a very important point: The first cultivation after the plants break ground should be deep—as deep and



PLANET JR. CULTIVATOR.

Price $5.50. For sale by A. I. Root, Medina, O.

thorough as is possible with a strong horse. Then give them the soil to grow in, and let *all* after cultivation, without any exception, be shallow—about 1½ inches deep is all that I will allow.

I consider the time when cultivation is done as important. We aim to never let a crust form after a shower, but get on and stir the surface just as soon as a horse will not do injury by packing the moist soil. We must be careful and not

start too soon, and be ready to rush things just the moment the conditions are right. If it rains again in 24 hours, no matter; we cultivate again as soon as it is dry enough. If it is dry weather, and does not rain at all, we cultivate again within a week any way, as the earth settles together and needs it by that time. No attention whatever is paid to the number of times that we cultivate; we just do all we can for the crop.

At an institute in Wisconsin I heard one of the most successful dairymen in the State report that he never said to his cows, "How little can you get along with in the way of food?" but, "How much can you possibly make use of?" Thus do we try to take care of our potato crop. With our long rows, and tools, tillage is cheap, and it pays, if properly done and always on time. We do not try to get along with one cultivator, but have three at least—one for each man on the place. I seldom need to do any cultivating myself, but I must have a tool ready so I can when we get in a tight place. Suppose it rains Friday night, and the soil is not dry enough to work until 10 o'clock Saturday. My son and man could not get over our field by night. Three of us could, and then I could go to church Sunday and feel entirely easy, as though I had done my part—as though I had not been "slothful in business," but "serving the Lord." We do not stop cultivation as long as a horse can get through between the rows; and a horse that is used to it will go through without doing much damage when the tops fairly cover the ground. The old rule, to stop cultivating at blossoming-time, was all right for the tools and culture of that time. With our shallow culture, and narrowing of cultivator toward the last, we can do no harm under any circumstances, and may do some good. As long as any soil is exposed to the sun, it is better to keep the surface lightly stirred. When the vines cover all, then shade will take the place of cultivation.

I haven't said any thing about hoeing by hand. We do not do any, except in some extremely wet seasons, or at the ends

of the rows where the tools do not do good work. We keep our crop pretty clean, and have for many years, by working in the line given above. Of course, we do not keep *every* weed down. Here and there one (some wet years quite a few) will come up in the hills. These we pull when they show above the tops of the potatoes, if the soil is wet, or cut them off if it is dry so pulling would disturb the tubers. But we haven't done very much in this line for some years. We have no iron-clad rule on this point, except that our potatoes shall be well cared for. This can be pretty thoroughly done by machinery, rapidly and cheaply; but if hand work is ever necessary, they get it.

I have tried to give you our practice; but a little preaching has been worked in, I notice. We will now consider more fully

SOME QUESTIONS CONNECTED WITH CULTIVATION.

What do we Cultivate for?

To keep weeds down, and the surface mellow and fine, so as to let air in and check evaporation from below. These are the main reasons. By "cultivation" I mean, of course, all stirring of the soil—harrowing as well as the work done by the weeder and different cultivators. Have you ever stopped to think how much damage weeds do? There is no question on these points; they eat up plant-food and deprive your potatoes of it just as certainly as a rat eating some of the oats fed your horse cheats the horse out of some of his food. If *you* let them grow they *will* eat, and *you* pay the full bill in potatoes. And, what may be still more important some years, weeds will drink. And do you know how much they will drink? Prof. Hunt told us at an institute this winter that weeds that would weigh one pound (dry weight) had evaporated from the soil 300 pounds of water. Think of this when you let weeds grow, particularly in a dry year. Potatoes need abundant moisture; weeds rob them of it. Are you going to let the tramps eat and drink at your ex-

pense? Are you going to treat them better than you do your own family? Alas! some farmers do. Shame on them! Let us do all we can, friends, to show them more businesslike and manly methods. With drained soil and proper food, and persistent, systematic effort, we can keep weeds practically down, never let them see daylight (nothing short of this is perfect), and still we shall only be giving the crop the tillage that it needs and that it will pay for. The weed-fighting has really cost nothing to speak of. What did Providence give us weeds for? Partly to oblige us to till well, perhaps.

After a shower the surface of our fields dries off; and if the soil is in the least heavy a crust forms. This is hard, and quite impervious to air, and the evaporation from this unbroken surface is great. There is not usually rain enough during the season to supply a crop of potatoes with all the moisture they need. There is, however, much moisture accumulated in the subsoil below. This works up toward the surface by what we call capillary attraction, the same way that oil rises in your lampwick. In this way a crop may get considerable moisture over and above what comes directly from the clouds during the growing season. There is a limit, of course, to this supply, and we may save it from waste, not only by keeping weeds down, but by having the surface lightly stirred. This loose broken surface acts as a mulch, just as effectually as though you had put some straw on the top of the ground. The water works up through the firmer soil below and supplies your crop, but it is prevented from reaching the surface, to any extent, where sun and wind would drink it up, by your mulch of loose earth. On good soil a man who is as saving as possible in this line may get a fair return, even without any rain at all. It is simply wonderful what man may do. But *he* must do it: Nature will never do it for him. God furnishes the rain and the brains. You are a free agent to use one or both or neither, as much or little as you please. Do you see now why we are so anx-

ious to stir the surface after a shower? why we harrow the field as soon as it is plowed? why we have the surface covered with second-crop clover all winter before plowing (one reason), all in this same direction of saving moisture? We had a tremendous rain the other night, but it did not run at all on my clover-fields, where we shall plant potatoes this year. It soaked down, and part is stored up to draw on when needed.

I hope it will not seem like bragging when I say we have sold thousands of bushels of potatoes to farmers, during dry years, who planted the usual quantity of land in the spring. Why did they have to come to us in the fall?

It is true, that stirring the surface causes the soil actually stirred (say an inch or two deep) to dry all the faster; then this dry loose surface prevents the waste, for the most part, of the large quantity of moisture below. And do not forget that air in the soil is necessary to the growth of plants. You give it a good chance to enter when the surface is loose, instead of dried and baked. During a wet time, cultivation is not needed on well-drained soil except to keep weeds down. When showers come daily, tillage may stop; but be sure to stir the surface right after the last one. Better do the work for nothing five times than miss having it done at this one important time. It would be easy to grow potatoes if we knew beforehand what the season and the weather would be. The best we can do is to be always prepared for the worst.

The amount of tillage that will pay depends somewhat on the fertility of the soil. For example, my friend J. M. Smith, who manures tremendously for garden crops, does not cultivate more than half as much as I do. Excessive fertility will take the place of tillage partly. Such soil will not lose moisture as rapidly by evaporation. Mr. Smith's tillage would be a partial failure some dry years on my ordinary farm land, which is not any thing like as rich as his. So we are both right in our practice.

I have said that all cultivation after the first time through, is shallow—only *about* 1½ inches deep. Now, I want you to know that I am *about*, and tending to this matter. I *know* that no careless man is "riding" the cultivator and sinking the teeth three or four inches. I will have no boy work in this line, but a good man, and he is plainly told that he might ten times better be sitting in the shade than running a cultivator deep in my potato-field. Roots pass all through the soil, searching for food. The soil was made for them to grow in. The more they can have, the better But practically they can get along without 1½ inches of the surface pretty well, and we must have about that much to move to keep weeds down and check evaporation. We do not need more, and it is senseless waste to take it. Deep cultivation diminishes the feeding-ground, or destroys masses of fibrous roots and puts the plant to the expense of growing them over. I prefer to have my vines growing tubers, without having to stop to repair damages. This matter of damage, however, will be governed somewhat by the weather that follows the tearing-off of the roots. If it 's hot and dry, it will do more damage than if wet and showery.

I have a neighbor who is a first-class farmer. One year our potato-fields were side by side. We both planted at the same time, in the same way, the same variety of potatoes. He began planting next to my line, while I began on the side of my field farthest from the line. We were about a week planting. This made my potatoes next to his about a week behind. They came up later and kept just so much behind in spite of the best care we could give. I couldn't get ahead of my good neighbor in tillage. Really my field averaged about like his, but it troubled me to have them a little behind where they were side by side—don't you see? I used to go out every evening and look at them, but his kept the start they had. One day when I was cultivating I looked over and saw a young man cultivating in the next field. As I watched him it seemed to me as though he was bearing

down on the cultivator-handles. At night I went over and looked, and he had done just that thing. The wheel on the cultivator was properly set, and the frame expanded as wide as would answer, and then the man had put his weight on enough so the rear teeth on each side had gone down, close to the drills, some four or five inches. For an instant I felt glad, for now I knew the race was mine; and then better feelings prevailed, and I was sorry that such a mistake had been made. It did not rain for some time, and was quite dry, and those potatoes came almost to a standstill, while mine grew right on as before. The damage done in that one day was very great. I have told this bit of experience only with the hope that it will help to impress this point on your minds. There is no theory about this. I *know* that I am right.

You will notice I speak of one-horse cultivators only. I have tried the sulky cultivators, three of them. As made now they do pretty good work, but not quite as good as we can do with one horse; and in our small fields the damage from turning at the ends is considerable. With one trained horse, scarcely a hill is injured. We are small farmers, doing our best. If living on a great farm where 100 or 200 acres of potatoes were planted, we might leave a head-land to turn on, and use sulky cultivator, and ride. One would not get along any faster, however. We do a row at a time, the same as they do, and have one less horse to tramp the ground.

The Iron Age cultivator and harrow combined is the nicest tool I ever saw to use in the fruit-garden to cultivate strawberries. Put the cultivator end of the teeth down, except the two next to the row. Have these two with the harrow end down, and not slanting back, but perpendicular, and raise them about an inch higher than the others. You can then run, actually, within an inch or two of newly set strawberry-plants and not throw any earth over them. The harrow-teeth will move the leaves around and not hurt

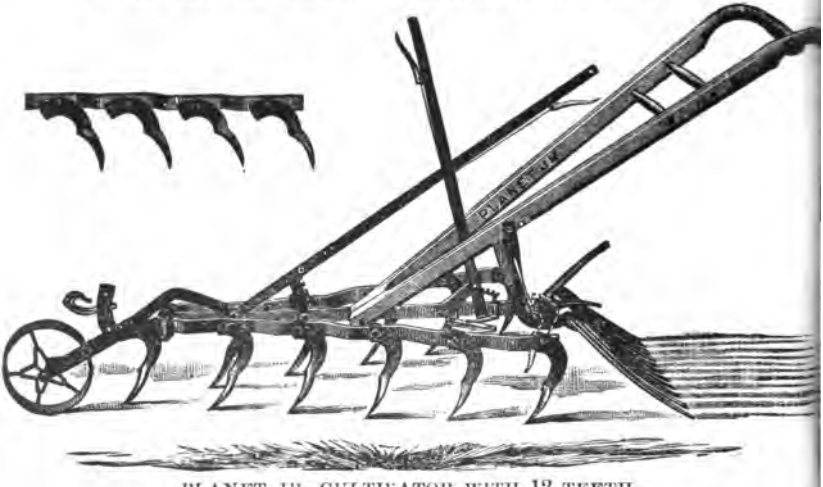
them, and stir the surface so as to prevent weeds starting, leaving very little to be done with the hoe. We fix it much the same for potatoes when they are small.

The picture (p. 94) shows the Thomas harrow as we use it for harrowing the freshly turned sod, except that we generally use three horses. When harrowing potatoes, one should never ride. The harrow is heavy enough. There are other smoothing or slanting-toothed harrows (slanting backward) made. I have always used the Thomas harrow, and prefer the old style, teeth *not* reversible. The patent has expired on this harrow, but you will not be likely to make as good a one as you can buy. If I could have but one harrow, it would be this, and next the Cutaway, for digging up hard ground, as pictured in another chapter.

Now, friends, probably 200 farmers have written me asking me to give all dimensions of frame, teeth, etc., and the slant, and all particulars, so they could make a smoothing-harrow. I simply can not answer such questions. The spirit is willing, but the body gets tired beyond endurance before piles of letters of that kind. With the consent of your most sincere friend the publisher, Mr. A. I. Root, you have been given pictures, and address of manufacturers of the tools I would buy—the best I know of; and this is done without one particle of pay from them. It is done to help the introduction of good tools in this line of potato culture, and it is done for *you*. Don't ask us to do any more. While I am about it I may as well say that neither for love nor money could any implement get itself advertised in this book. We are using every tool named, and tell you just what we know they are.

Breed's weeder will be of little use to you on hard, heavy, stony, or rough land. Don't buy it for such conditions. On a light, clean, mellow soil it will do at a rapid rate just about the same work you do with a steel garden-rake in the garden-beds. A first-class farmer will be delighted with what he can do with it, under such circumstances. It will not root

up weeds that have got well started, but should always be used on entirely clean soil, to stir the surface to prevent weeds from ever seeing daylight. All other tillage-implements should be used in the same way. You want to remember that the weeder and harrow get over a good deal of ground in a day—12 to 20 acres in 10 hours, so one may go over it several times during a season, and still the cost will be much less than the work could be done for by hand.



PLANET JR. CULTIVATOR WITH 12 TEETH.

Price $7.00. For sale by A. I. Root, Medina, O.

The handles on the weeder enable one to bear down or lift up, according to the condition of soil. When there was much bearing down to do I have sometimes tied on a weight of some 30 pounds. I have given you a picture of the Iron Age 14 toothed harrow and cultivator simply because I have used it one season. I have lately learned that the Planet Jr. people have made a 12-toothed harrow and cultivator, which

is quite similar, and probably just as good. I shall try one, any way, this year, as we need another; and Planet Jr. tools have always kept at the head, we have found; and another thing I notice in their 1893 catalogue is, that they have gotten up some "depth regulators" to go on the rear teeth, to keep them from going down too far. I shall try them, certainly. They will be as valuable as the wheel, which regulates the depth in front, if they work as well. Only a year ago a certain manufacturer of cultivators wrote me, saying they would be glad of any suggestions that would help them to improve their tools. My answer was, to get up something, a wheel or slide, to use in the rear to prevent the teeth from going too deep, as the wheel did in front. Their reply was almost insulting. Perhaps if the Planet regulator works well they may wake up to the fact that the writer was not as silly as they thought.

This subject of cultivation is a very important one. There are ever so many points which, if followed out fully, would each make a chapter as long as this. This chapter is hardly more than suggestive to start you to thinking and studying in these different lines. I am afraid friend Root will be wanting some points explained more; but there is not room to much more than make statements of facts, as already we have given 50 per cent more space to this subject than was occupied in the old edition.

CHAPTER XIII.

Bugs and Blight.

Where the Colorado beetles and their larvæ are troublesome, most growers spray the vines with a mixture of Paris green or London purple and water. Some few use the poison dry, mixed with land plaster. There are machines of all kinds for applying the solution, from a knapsack sprayer, to be carried and operated by a man, to a cart drawn by a horse, which sprinkles several rows at once. Either of these plans ends the beetles and larvæ. We bought a machine, and began using Paris green and water—one of the very first made for this purpose. Before that we had sprinkled the potatoes with a garden-sprinkler, or a hand-broom and a pail of poisoned water. Now, so far as I am concerned I should prefer to drop this matter right here. The way we have actually done for the last dozen years or more is not according to the fancy or practice of many growers. But I might as well tell the truth, perhaps. I disliked to have poison around all summer, particularly when the children were young. Our land is right around the house, our home, and I did not feel quite easy about having the wind blowing over a dozen acres of poisoned tops and then right through our grounds. I felt as though if too much Paris green would kill potatoes, a little would injure them. (A careless man killed two acres dead one forenoon.) I asked Prof. Lazenby, of the University, what he thought about this, and he said he thought I was surely right. Again, I must put on poison myself, or be right with the man doing it. I could not afford to run any risk of carelessness. Also, if a rain came just after I had worked hard to spray a field, I might go and do it over.

All these things together led me to experiment a little

with hand-picking, and we found that, by going at it systematically and on time, we could actually prevent all damage from these pests at less expense than we were at when using poison. Exact figures were kept, so I knew this. Then *I* was released, for cheap hands could pick bugs, and no injury was done to vines. The larvæ did not have to eat the vines to get the poison and die. Let me give you an example or two of how I have been "sat down on" in regard to this point. At the "round-up" institute, in Wisconsin, on "Potato day" I was called for my experience. I touched this matter very lightly, and spoke of the injury that I thought was done to vines from using poison. Mr. Smith had just been telling of his big crop of some 1700 bushels on 4 acres. Instantly one sharp friend called out: "Smith, did you use poison on that big crop of yours?"

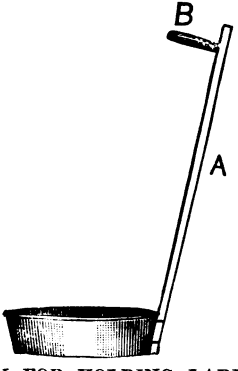
"Yes, sir."

"All right; that is all I want to know. That was a good enough crop for me, injury or no injury."

Friend Carman, in his book, "The New Potato Culture," says: "When writers advise us to gather the beetles by hand, we want to tell them that, if they would practice this advice for one season, they would not care to offer it again." That is a little hard on me, isn't it? But I think we have tried it 15 seasons, and two years on 24 acres, two on 18, and the rest on about 12. The trouble with Mr. Carman was, that he tried it in a small way, I presume, and perhaps in a locality where there were many small patches within flying distance. I tried it on a farm, away from any village. I would never undertake to pick beetles off on a little garden-patch, particularly in town.

Mr. Carman prefers using poison mixed with plaster, rather than in water. Briefly, he says the poisoned water, for the most part, does not settle or dry upon the edges of the leaves; but the poison collects, as the water evaporates, near the center, or mid-veins, or depressions, so that the beetles may eat up the best part of the leaf ere they encoun-

ter the poison, and so the leaves are for the most part destroyed. I agree fully with this; but hand-picking prevents the eating of the edges of the leaves. Again, he says: "Stir the water as we may, the upper portions will always hold less than the lower portions, where the insoluble heavy powder collects in larger quantity in spite of constant stirring. The leaves of the potatoes are harmed by this." This I believe, and always have. But did you ever hear the caution, when applying the poison dry, "Keep to the windward; don't breathe the dust"? Did I want my (at that time) little children playing to the leeward of 12 acres of tops white with poison and plaster?



PAN FOR HOLDING LARVÆ.

Our plan has been to pick the beetles just as soon as the plants break ground, and keep at it *persistently* for a time, thus preventing the laying of many eggs. In this way we have had but little trouble with the larvæ. We have picked the beetles in quart glass fruit-cans. They can not crawl out of these handily. For gathering any larvæ that may hatch, we use a pan with a handle attached, as shown in picture, so we do not need to stoop. The pan is carried in

the left hand, and a long paddle, made of a light barrel-stave (which is just the right length), is used in the right hand to gather the larvæ in from a row on each side. We have a tin pail, holding six gallons or more, with a tight cover, at the end of the field. Into this we empty beetles or larvæ. A dose of boiling water at night fits them for the fertilizer-pile. I should say that beetles and larvæ are not nearly as numerous as they were ten years ago—probably not one-fifth as many. Our neighbors pick beetles too; and this destroying the foes and leaving the friends may have helped us some. When poison is used, the foes of the beetles may be destroyed too.

At first we hired children, partly, to pick the beetles. Late years it has been done by a man from town, who is not able to do heavy work, and doesn't need to, and still who enjoys getting out in the field and pure air. He has taken the job for his board, and it was not a heavy one. Again, we must keep just so much help any way; and machinery enables us to care for the crop so rapidly that there is time that could be devoted to this purpose, if needed, that would cost us little.

Strong-growing varieties, fertile soil, potatoes always on fresh land (rotation)—all these things help. Bugs eat the weak little plants worst. You have seen it. Nature is down on the underling; "survival of the fittest;" "unto him that hath shall be given." Do you say those cattle are not doing well because they are lousy? You are twisted. They are lousy because they are not doing well. Care for them better. Care for your potatoes better. Some authority has recently declared that yellows in peach-trees was caused by lack of fertility. Bugs would do precious little harm here to an acre of potatoes fed so they would grow into a solid mass of vines in six or seven weeks after coming up, even if not one was picked off.

We observe the habits of the beetles. They fly only on a warm day, and come from where they were the year before

to the new field. We watch the outside on such days. They always alight near the edge. Three or four times a day we run over the outside rows.

The Blight.

We have not had very much trouble in this line. But we raise early potatoes as a rule. Once, many years ago, we practically lost our late crop in this way, while early ones yielded some 240 bushels per acre the same year. Within the last few years it has been found by our experiment stations that spraying with what is called the Bordeaux mixture will prevent injury from blight, more or less. Prof. Goff says this blight is not the same disease that causes rot at all. I am inclined to think this blight has been present more or less for many years, but is on the increase lately in potato-sections. It is simply a blight, or rust, that attacks the foliage and causes it to die before its time. Unless one noticed carefully, he would think the potatoes had ripened, perhaps. Our early potatoes may die in 75 to 100 days from the time of planting. When they grow the full time the crop is much increased; 10 or 20 days cut off at the last end diminishes the yield decidedly. We do not, however, have weather suitable for this trouble to thrive in until near the end of the season, for early-planted early potatoes. From what we know now, if I grew late potatoes I would spray them every time. It is a question whether it will pay on our early ones. I asked Prof. Green, of our station, last year, what he thought about it, and he doubted whether it would pay me to spray. And still I am inclined to try it this year. If I can keep my potatoes green a week longer, I believe it will pay. Prof. Goff gave us the figures at the "potato institute," on the cost. He thought $5.00 an acre would cover it, about half for material and half for labor. Spray three or four times, beginning when plants are about six inches high, and spraying once in two weeks, or oftener if it rains very hard. Prof. Goff says the Bordeaux mixture of itself will

help about keeping bugs off, and you know Paris green can be put in at the same time, if you wish. It seems to me that the coating of leaves with the mixture would be injurious to the vines, somewhat; but perhaps it is better than to risk their dying from disease.

Did you ever hear how the value of this mixture was discovered? It was not studied out, but hit on by accident, as is often the case. Of course, the mixture is named after the city of Bordeaux, in France, where it was discovered. As I remember, some one was troubled by schoolchildren eating his grapes as they passed along. So he got some whitewash (lime) and put in some sulphate of copper and sprinkled on his vines to protect them from the children. But he had done far more than he had arranged for. It turned out that the grapes on the sprayed vines failed to rot, as they did elsewhere, and experiments soon showed that an important discovery had been made.

I have thought it best not to give the formula for the Bordeaux mixture. This will not reach readers in time for use this season, probably. By another year some change may be made. You can learn how to prepare it, from latest experiment-station reports and the papers.

Since writing the above I noticed in the papers that our Experiment Station had arranged for an exhibition of spraying-machines on their grounds, and went there to see them work, and learn what I could. I went with an impression—that I had better spray my potatoes this season. I now intend to do so. I have figured on the cost pretty carefully, and it will not take many bushels per acre to cover it. It is mainly the cost of material, as we can manage to do the work at odd spells; and they make the mixture so much weaker now that the cost is not large, and the sprayers can be managed so as to waste very little—spray the plants only. My pencil tells me to get a knapsack-sprayer, and I think I shall. They cost only one-fourth or one-third as much as the carts. Of course, one can not get over the field nearly

as fast; but there is more than this to think of. On a large farm, with 100 acres of potatoes, and head-lands to turn on, I would get a cart, as well, perhaps, as a sulky cultivator. In our little fields the damage from the horse and cart turning right on the vines at each end while spraying the field, and some four times during the season, from the time the tops are six inches high until they are full grown, would more than pay all the cost of getting the mixture put on by hand. This is the way I figure: In my lots the turning on vines would decrease the yield on six square rods, at ends, about one-half. That is, we should lose about three rods per acre. A man can spray four acres a day with a knapsack. I did it years ago, and others tell me they have lately, and that it is not very hard work to run it. I tried the machines at Wooster myself. This would cost me, at $1.50 a day for labor, and spraying four times, $1.50 an acre for hand-spraying. Now, I had rather take the three rods of potatoes and pay the $1.50. My potatoes generally bring more than 50 cents a square rod. And then the looks! I shouldn't want Mr. Root to come along and see the vines all trodden down at the ends, and half spoiled. I don't want to see it myself, and don't think I shall.

Prof. Green very kindly told me all about the spraying business. We must begin spraying while the potatoes are small. It will not do to wait till the disease appears. There are more or less germs in the air at all times. These lodge on the leaves, and get a foothold. When they once do this you can not do any good spraying. The spraying is to coat the leaves with a mixture that will prevent the germs from taking root. Hence you must begin when the plants are about six inches high, and then in ten or fifteen days spray again, to coat any new leaves that have grown out, and so on until growth practically ceases. I do not know what make of knapsack I had better get. There is probably not much difference. I want one large enough to carry mixture enough to go down and back on my sixty-rod rows. Strange

as it may seem, I could not find out from the many present at Wooster how many gallons were needed for an acre.

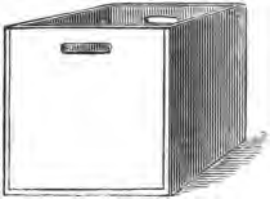
CHAPTER XIV.

The Use of Bushel Boxes.

At last we have the crop grown. We have carried it through bugs and blight, scab and drouth. We have done our best from beginning to end, and now we must arrange for securing and handling our crop. The next four chapters will be devoted to this part of the business. When we first began growing potatoes they were handled in the old way, of course. When picking up we would carry them together into heaps, in bushel baskets; or we would drive along with a wagon and empty the baskets into the wagon as we picked them up. The potatoes had to be picked up by hand from the heaps; from the wagon we could shovel them up. As we went into potato-growing more largely we found this part of the business was behind. It cost us too much to handle the crop, and there was too much lifting, and the potatoes suffered from so much handling too. Well, the result was the making of a lot of bushel boxes. For several years we used these for marketing early potatoes in the city, as long as the skins slipped at all, and it saved us much work and made us some money.

First take a look at the box. The first ones made were 13 inches by 16 by 13, all inside measurements. The sides and bottoms were made of ⅞ stuff and ends of ⅝. Hand-holes were cut in the ends, as shown in the picture. The upper corners were bound with galvanized hoop iron, to make them strong. Getting only a few, so, the price I paid at a box-factory was $25 to $30 a hundred. The publisher of this book, my friend A. I. Root, saw, some eight years ago, that they were a good thing, and went to making them on a large

scale, and has sold many thousands at very low prices; and his boxes are very light and nice. One of my neighbors thought one man could make boxes as cheap and good as another, and had some made here in town, where, of course,



OUR BUSHEL BOX.

they did not make a business of doing such work. Another sent to Mr. Root, as I advised, and got his boxes much cheaper, after paying freight, and they are ever so much lighter and neater. Take my advice: You had far better send to Mr. R. for boxes in the flat than to try to make them yourself, or get them made where the manufacturer has not had large experience, and hasn't the knowledge of just what is wanted. If you don't take my advice, after you have lifted three or four pounds of unnecessary weight a few thousand times you may come across some of Mr. Root's boxes, and see where you have missed it.

Now, when digging for early market my men just laid the tubers in these boxes as they would eggs (no throwing in); and as fast as one was filled a cover was put on. These covers are simply pieces of inch-thick board, cut about 15 by 18 inches. Potatoes that were dug one day I took to market the next morning, on a spring wagon, of course, with a canvas cover over them to protect from the sun as well as rain. They were set off at the grocer's, and then put by him into his delivery-wagon and taken to his customers. They thus reached the consumer just about as nice and fresh as though he dug them out of his own garden. This was quite a new departure, and boomed our business greatly for a

time. The boxes were left at the grocery, and empty ones taken back; and with best customers they were left in the consumer's cellar until he wanted another bushel. I remember once leaving 30 boxes at a grocer's while I went on with the rest of my load to another place. When I came back he had delivered every bushel to his customers, who had orders in for them. They were dug in the afternoon, immediately covered, and by 11 o'clock the next day they were in the consumer's cellar, 12 miles away, without any handling or bruising, and I will warrant they gave satisfaction. There is plenty of demand for nice things at paying prices, while ordinary goods are dull at low prices. The sized box spoken of is right to set in an ordinary three-foot-wide wagon-box, as two boxes endwise just fill across the wagon-box. (Mr. Root, I notice, now makes them a little shorter, which is handier.) The box on my spring wagon is a little over 12 feet long, so 20 boxes can be set in the bottom, and two deep make 40, our usual load for two horses. But they can be set three or four deep, if desired. The boxes hold a bushel level full, so they can be set one on top of the other. Do not round them up, or you will cheat yourself. They hold a full bushel when a straight-edge drawn across the top just touches the potatoes.

With plenty of these boxes my men dug right along while I was gone to market, and 15 minutes was time enough to load my wagon in after I got back. There is some dead weight to carry, but it pays twice over. The potatoes are in the nicest possible shape, and your customers will soon find it out, and there is no chance for quibbling about measure. There is just a bushel in a box every time, while baskets vary in size, and can easily be heaped too much or too little, thus giving a chance for unpleasant words between buyer and seller.

Later in the season, after the potatoes are ripe, and there is no longer any need of handling them so carefully, I drive through the field, and two men will empty 50 or 60 boxes

into my wagon in a very few minutes, and the boxes are left ready to be filled again. This, for drawing to market. If drawing to cellar or barn or pile, for storage, we would set the boxes right into the wagon, and, after emptying them, put them back in and return to the field and scatter them along as we drive down toward the back end; then turn around, and two men will put filled boxes in as fast as I can possibly set them up, and in a very few minutes another load is on. We have handled a good many thousand bushels in this way. For field work I consider boxes far better than sacks, although some use the latter. They will wear out fast. Our boxes have been used some 15 years, and are not used up yet. But when it comes to loading a car from cellar or barn, I prefer sacks. We shovel a bushel, as nearly as we can (where a load is to be weighed), into a two-bushel sack, give the top a twist, and toss them into the wagon. It would surprise you, perhaps, to see how quickly two men will toss 100 bushels into our wagons, while I load them, in our barn, and how quickly I put them into the car while they empty them. One man at home can fill sacks for two more loads while we are gone. This is the best way I have found to load potatoes on to a car. I have drawn them from the field to the cars in boxes, but it is almost too much dead weight, and boxes are in the way at the car after they are emptied. Perhaps I may as well say right here, before I forget it, that you want nice wooden shovels for handling the crop, if they are put into the wagon in bulk, or for taking them out of the cellar.

You will find these boxes equally nice for handling apples, and for several other purposes. They are just the thing when we are planting, too, to handle the seed and cut potatoes in.

Now we have the handling improved on, we want wagons for drawing the potatoes to market, handling the boxes, etc., to match. We will take up this subject next.

CHAPTER XV.

Suitable Wagons for Handling; Potatoes are Bulky, etc.

One can not handily put a large load, or what a good team can readily draw on hard roads, or an ordinary farm wagon. You will find few wagons in this town that will hold 40 bushels, with the top box on. You will find hardly a single one that would take on 50 or 75 bushel boxes, unless the hay-rack were used. Now, when the roads are good our horses can draw 50 to 75 bushels of potatoes to the depot as well as not, and it seemed to us a simple matter of business to arrange at once so we could put on a big load handily. Potatoes are hard to handle, and, of course, we wanted our wagons so fixed that we wouldn't have to lift them very high to put them in. We studied up for ourselves something of this kind some twenty years ago. We have had them in almost constant use all these years. They suit us perfectly, and we should be lost without them.

Our wagons are ordinary ones. Our device for carrying a large load is simply a light, neat, portable, flaring top box. It is no higher to lift over than a common top box. It can be taken off or put on in one minute, and it will hold a big load. We have two wagons. On one we have drawn 66 bushels of potatoes in bulk, although 60 fills it pretty well. The other wagon holds 20 per cent more. We find them just the thing for drawing any bulky articles. For sawdust, bran, ears of corn, stovewood, etc., they are complete.

Fig. 1 shows one side-board, 18 inches wide, for a ten foot wagon-box. Fig. 2 shows one of the three sets of irons that are on the side-board. The inside iron is one inch by one-half inch. The outside iron is one inch by one-fourth inch,

and the brace is a round rod one-half inch in diameter. This is amply strong enough to hold all the wood one can pile on, a big load of hay, or all the potatoes that can be heaped on.

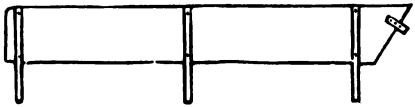


FIG. 1.—HOW TO MAKE THE TOP BOX.

These irons are bolted to the side-board, and simply slip on to the side of the wagon-box, one on each side. If the top box is to be used very much, it is best to put some thin plates of

FIG. 2.

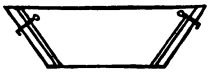


FIG. 3.

THE END-BOARD OF THE TOP BOX.

band iron on the wagon-box, to prevent the side-board irons from wearing into it, and to prevent splitting. For a 12-foot box I use four sets of irons on a side. Never fear but that they will hold all you can pile on. I drew from sixty to seventy bushels at a load six days in a week one fall. Fig. 3 shows the back end-board, which has two wooden cleats on

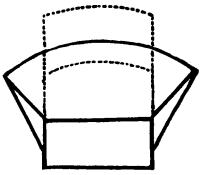


FIG. 4.—ADVANTAGE OF A FLARING-TOP BOX OVER ONE WITH STRAIGHT SIDES.

it to prevent splitting, and which fits in between two wooden cleats on the inside of each side-board, and is held in place by hooks which hook into eyes on the side-boards.

In Fig. 4 the plain lines show a cross-section of box, top box, braces, and top of load. The lower dotted show, at a glance, how much less a common top box of the same height would hold, while the upper dotted lines show how very high the common top box would have to be in order to hold as much. Still, the dotted lines show the kinds mostly in use, and the high one, or double top-box, will cost more than my kind, and is much harder to load into. The brake-handle comes up through a hole in the side-board near the front, and two pieces of boards are nailed together to set around it, so as to keep potatoes from interfering with its movement—a simple little device that any one can study up without a cut.

It is stating the case very mildly to say that these top boxes have been worth hundreds of dollars to me during the twenty years they have been in use on my farm, for drawing potatoes and other bulky articles; that is, that I am that much better off than I otherwise would have been.

I do not want any one to overwork his horses. I assure you we do not. But it worries me greatly to see a farmer, who is in debt and sadly in need of larger profits, go to town with 50 per cent less load than he might just as well draw, simply because he does not study to do his best. I have no top boxes for sale. There is no patent on them. Any wagonmaker can get up a set from these pictures and the description. When the roads are bad we sometimes use three horses abreast to draw these big loads. I have moved my entire crop, alone, in this way, either to the depot (2½ miles) or to Akron (12 miles), without paying out any thing for help. I got along almost as fast as if two teams and wagons had been used, and saved the wages of a driver. Yes, friends, I have done all these things myself, and many more that won't get into this little pamphlet. I am not talking to you about something that I know of only at arm's length. Week after week and month after month have I rode on these wagons and driven these three horses abreast.

Perhaps as much has been made by the three-horse business as from the big wagons. Suppose two horses will draw 3000 pounds of load. The wagon weighs, say, 1000 more. Each horse then draws 2000 all together. Now, if you put on a third horse, and the wagon is strong enough to carry it, this horse will draw 2000 pounds more, and that is *all* load—no more dead weight. See? In other words, two horses draw 3000 pounds of load and three horses draw 5000 pounds. If you can earn $3.00 a day with the two-horse team, you can make $5.00 with the three-horse team. This have I done week after week, alone, with my own hands. Thus have we worked up. In 1883, when we had the greatest crop of potatoes ever grown by us, nearly 7000 bushels, we actually received a *thousand dollars* more for them by drawing them to Akron, direct to retail dealers, than we could sell them for on track at our station to large dealers. We sold some to try it. A thousand dollars more than regular carload rates is a pretty nice sum; but without businesslike arrangements for moving them we never could have got them there. Friends, do you remember I am writing about a little fifty-acre farmer, who has only 35 acres of land he can plow, and part of that not very good? Our cash sales that year reached nearly $3000; but that was our very best year.

Now, friend Eliott's three-horse whiffletrees that are shown in another chapter are just the thing for using three horses on a harrow, as told of. They can be used on an ordinary two-horse pole, he says. I have not tried them in that way, as I have a "direct-draft" three-horse pole, of my own make, which is far better. Like the side-boards it seems perfect. I have driven it through the most crowded streets of Akron and Cleveland. It is business to use it for drawing large loads long distances, or short distances when the roads are bad. We simply take off the common single pole and put on our double one, which is made to fit right in the place of it. The double pole is an extra-heavy pair of thills. One horse goes in the middle and one each side. You can

use the three-horse whiffletrees on top of the thills, and then you have a perfect direct draft. The two poles are each ironed at the end, the same as a single one, and we use two three-foot neckyokes, the middle horse taking one end of each. Put your best horse to back in the middle, and you will have no trouble in handling a large load. The brake, of course, holds back going down hill. Each pole is about the size of a heavy carriage-pole. Three horses hitched this way will draw as much as four when two are ahead of the other two, and are far easier handled. I have never bought any regular three-horse reins, but use two-horse ones by putting on, temporarily, two extra check-reins made of hitching-straps.

Now, for drawing potatoes to market before they are ripe one *must* have a spring wagon. It is always better to have one. The potatoes are bruised less, and look nicer. I could not have carried the Akron market by storm, as I once did, without springs. No, sir. Your produce must not only *be* nice, but *look* nice. My great wagon was not only painted and striped in those days, but it was varnished! A huge load was put on, standing up high in the middle, so every one could see the nice tubers. Without springs they would have jolted down flat, and looked mussed and wretched. There was a high spring seat for me to ride on, with a large umbrella attached, to keep off sun and rain. A clean heavy canvas cover was over the potatoes. Just before we entered the city this was often laid forward so as to show the load. It made people look. It advertised me and my product. How could any dealer stand back when there was a crowd around my wagon looking at the free show? It advertised his business, don't you see, to have a load that had attracted attention all through the city seen standing, and being unloaded, at his door.

But we had many ways for our money in those days, as we were but just getting on our feet, financially, and we used bolster springs of different styles under the boxes of our

ordinary wagons because they cost but little. They were not very satisfactory. I would now get a good platform-spring wagon for marketing. In just drawing to the depot, now, for shipping, we do not use springs.

Wife says I must explain about how we came to have so many potatoes in 1883. She is afraid some reader will think that too big a yield, knowing that our custom has been to grow potatoes on only a third of our 35 acres of plow land. Well, in the spring of 1883 we decided to build a new house, and that, of course, meant other expenses increased. We were anxious to furnish it as soon as possible, and we had barely enough to pay for the house alone. We have made it a rule to live within our income and pay as we go, as far as possible. So we decided to push a little extra and plant some 18 acres of potatoes. Then a severe freeze cut all wheat in this section down to the ground, and we feared it was killed. For fear of this we plowed up half our wheat in the spring and planted potatoes; so we had twice as much land occupied as usual, or about 24 acres. The season was wonderfully favorable, and the average yield was nearly 300 bushels per acre. On our best land it reached 400, by actual measure, before witnesses. I am tempted to tell you that some people thought us a little queer when we hired all work done connected with the building, even the drawing of the lumber down from the depot. Well, we tended to *our* business and reaped a large reward. We might have fussed around and saved $200, perhaps, on the cost of the house, and lost $1000 in the potato-field. After paying all running and living expenses that year, we found ourselves ahead about $1700 in clear cash. The house was well furnished in the fall, and every thing was paid for, cash down.

CHAPTER XVI.

Digging; When shall we Dig?

If you are selling in market, dig as soon as the potatoes are large enough so they satisfy buyers—that is, if the price suits you; and generally you will not be able to do better by waiting. I have often heard farmers say they dug a piece early and sold them. If they had left them until ripe there would have been a much larger yield. They also hesitate about selling early potatoes at a good price, because they would grow so much more if left that it would more than make up for any decline in prices. Usually this is a mistake. My potatoes have turned out the most bushels when dug just before they are fully ripe. They are plump and heavy; and as they ripen they do shrink some. I believe that the heaviest shrinkage in weight of potatoes takes place within a month, about ripening time, and it doesn't make very much difference whether they are in the soil, pile, or cellar. Shrink they will; and after that time, if properly stored at a low temperature, the shrinkage is not so very great. One year we were obliged to pile a good many potatoes, as the teams could not market them as fast as dug. Some piles were dug before much shrinkage had taken place, and it was a surprise to me how much they fell short when we came to handle them a few weeks after. We sold one big carload—657 bushels—when we began digging, just when the tubers were the plumpest and heaviest, by weight, at 37 cents, and the piles later in the season at 40 cents; but the 37-cent ones paid us the better.

I remember once drawing some very fine plump potatoes to Akron just when they were at their best. The skins slipped a little, but I had them on springs and in boxes.

The grocer who bought them put two or three loads into the cellar to keep. He was greatly surprised to see how much they had shrunken when he used them, months later. When we were drawing to market we always sold all we could when they were about in the above condition. They looked their best, and were fine to eat; but I always told people that, if they bought to store, they must expect heavy shrinkage.

But now suppose you do not want to sell by the load in early market. You want to store the potatoes, or load on cars in bulk and ship. In this case, we in this latitude *always* dig as soon as the potatoes are entirely ripe. This is when the vines are all dead and the tubers separate readily from the roots. We do this, even if it is in August; and if we do not want to ship we store them until we do. There is nothing gained by leaving them in the earth any longer, and there may be loss. I don't know about the scab increasing after the potato is ripe, but I do know that wireworms, white grubs, etc., continue to put in their work; and if they are numerous they may almost ruin an early crop left in the ground until fall. Again, after the vines die down, the sun may find its way into cracks, and the light injure the tubers some. They are certainly safer and better off in a cool cellar, protected entirely from light, than in the hot earth during August and September. You can keep them all right if properly stored. Of this we will write in the next chapter. There may be this single exception: If the potatoes are rotting it is generally considered better to leave them in the ground until the trouble is over. If you dig and pile them while rotting badly, you will get diseased tubers in with the sound, or the disease in the sound ones will be hastened on by the piling, and you may have no end of trouble in picking them over, and perhaps lose about all. A friend at Cazenovia, N. Y., wrote me last summer that he had dug some, and they were rotting right down; and, having had no experience, he was at a loss what to do. I wrote him at

once to let them be in the ground. Later he told me that he did just as I told him, and was largely the gainer. We have not had much experience with rot. One year we lost perhaps 1000 bushels in this way, in August. As soon as it came I stopped digging and selling, as it was almost impossible to tell sound from unsound tubers. About the first of September the diseased ones were all soft, and the trouble seemed to have stopped spreading, and we went on digging, selling, and storing. I took all risk on those sold, when they followed my directions, and no trouble ever came of it. This was the genuine rot, as bad on dry upland as anywhere; but our crop was so large that year that we hardly felt the loss. It was the great large choice tubers that rotted, though. Whenever the season is such that our richest land produces 300 bushels per acre, or more, we are apt to find traces of rot. With a big crop, on overrich soil, I should want to dig as early as possible, and sell for immediate eating. A young man wrote me the other day about a very rich, heavily manured piece of land, asking what variety he had better put on. He said old men all told him his crop would rot down. I told him his best chance was in planting Early Ohio, early, and digging them the moment they would go to market, and rushing them right off. He might thus get ahead of rot, his neighbors be taught that, where there is a will there is a way, and he might make a good deal of money.

Where potatoes are followed by wheat, as in our rotation, we need to dig as soon as they are ripe, to get them out of the way; but there are advantages all the same. Besides those spoken of, we have better weather and longer days than late in the fall. I might say a word more in regard to shrinkage. When we dig as soon as the skins stop slipping, there will be about 10 per cent shrinkage between then and the following spring. Of course, this will vary with season and variety. In a wet season, with a large growth, they will shrink more than in a dry year with a small growth. But

now if we dig as soon as ripe, and store temporarily until October, and then sort over and measure or weigh out a hundred bushels, there will be no practical loss in shrinkage on them until they begin to sprout in the spring. This in our cellar, which is kept cold, or in the pile in the field where seed are kept.

How shall we Dig?

This depends on how many you have to dig, and the conditions. There are a great many cheap diggers on the market, sold all along from $10 to $50 or more. They do a sort of half-way work. With conditions right, some do fairly well. The great trouble is, as a rule, they do not take the potatoes *all* out clean, and leave them on top ready to pick up. You can pick up what you can find, plow around in the soil with your fingers not a little, and then, when you get through, harrow the field and pick up some more; and then if you should plow it you would get another crop. This is a little hard on this class of diggers, but it is about the truth. However, circumstances make some difference. With a clean field and high hills, which we don't want, many of these cheap diggers would do pretty well, particularly if the soil were mellow; but not one will do perfect work, so far as I have seen—that is, take *every single tuber out* and lay it on the surface handy to pick up, and clear from soil. Few men have tried as many diggers as the writer. Day after day have I bothered over them, often with the manufacturer here in person, and that when I had a good digger in the field; but I have been anxious to find a good *cheap* digger that I could recommend to small growers. I am through trying. If a small grower myself, I would dig by hand with the four-tined fork. An expert can dig half an acre in ten hours, where the crop is kept clean and the soil is mellow. I give you a picture of such a fork in the hands of a young man who once worked for me some five years. He dug my crop in 1883, at a cost to me of just about one cent a bushel

(just the digging, not picking up). One week he dug from 180 to 190 bushels per day, for the six days. His best day's work in nine hours (he had to stop before night to cover up piles with straw, as I was absent), taking rows right through

THE BOSS UNPATENTED POTATO-DIGGER.

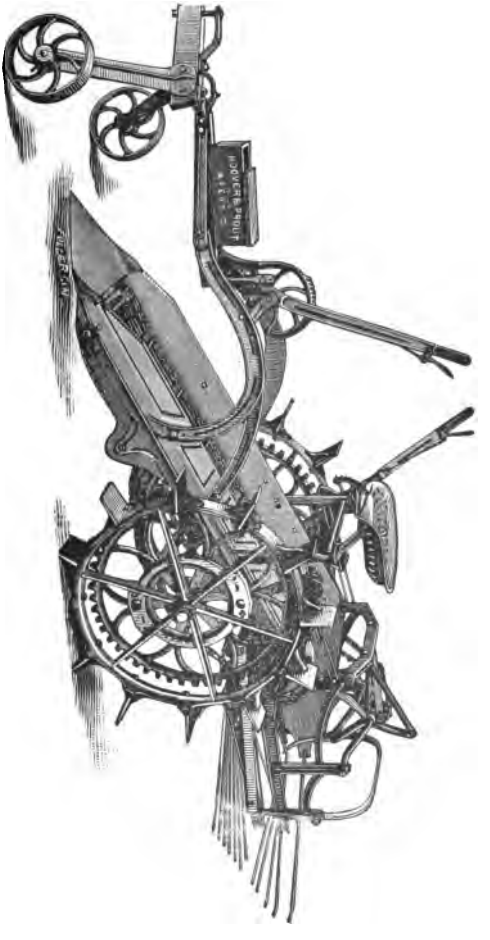
the field as they came, was 223 bushels. It took two good men to pick up after him and pile the potatoes, as we did then. Of course, the ground was clean and mellow, and the

yield large, nearly 400 bushels per acre, where he did his best day's work; and the man was a real expert. He dug nearly all of my 24 acres alone, getting done by the middle of October, besides helping some at other work. I know just how hard it will be for some farmers to believe this; but it can easily be proven, and isn't exaggerated in the least. I have seldom had a young man who, after a year or two of practice and showing, could not do pretty nearly as well. I saw last fall not a few fields where weeds were mowed off (a regular weed sod), and raked into windrows, and dried and burned, or drawn off before digging. Under such conditions my boss digger might have thrown out 50 bushels a day, as he was very quick and strong; but I doubt it. I have seen less than 25 dug by an ordinary man—not on my farm.

I wonder whether I can tell you how to use the fork so as to help you any. Set it into the ground just back far enough to never "stick" any tubers, and just deep enough not to miss any, and then, with a quick curved and backward flirt, scatter the earth and leave all tubers in sight. The ground should be mellow, so this can be done without putting the foot on the fork. With one-eye seed, in drills, my boss digger would walk right along and nearly always throw out a hill clean with a single motion. He had excellent judgment, skill, and great strength. It was very seldom that he "stuck" a tuber, and it seemed to hurt him when he did, and he wouldn't leave a bushel in the ground on ten acres. I consider the fork as far ahead of the hook or any other implement, for hand-digging, and with good help I would to-day take it in preference to any cheap digger I have used.

A Successful Digger.

Eight years ago I wrote that we should soon have a successful digger—it was only a matter of time. Soon after the first edition of this work was issued, one was brought out that, although not perfect, was good enough, so we used it to advantage. Soon another was introduced, made on the



THE HOOVER POTATO-DIGGER.

same general principle, and I feel entirely justified in saying, after several years' actual use, that it is the most perfect digger on earth to-day. This is the Hoover. You see from the picture that it is somewhat complicated and costly, and it takes power to draw it. These are the objections. They are nothing to me, but important to many. I can use it, and never break down, because I see to it that every thing is right, and tight and well oiled. I understand every part thoroughly; can detect the first click, if any thing goes wrong. The cost is nothing to one growing as many potatoes as I do. The interest and wear are very little by the side of money saved by doing the digging all myself, and having nothing to pay out, and being able to hurry up the work. Two strong horses might draw this digger on light soil; in fact, I have thus drawn it; but to go right along on heavier soil, or when dry, and to let it down so as to get under *all* tubers and not cut any, one wants three or four horses. I use four—one team ahead of the other, so we can take off the front team and use them on the wagon to draw in a load and bring out more boxes from time to time, leaving the other team with the digger.

Now, just what will this digger do? On my land, except on two or three little hillsides, it will go right along, unless it is too wet, and take *every* potato out of the earth, shake all earth off and leave the tubers in a nice narrow row on top, where they can be picked up faster than after the best hand-digging. You see, soil, potatoes, vines, stones, and every thing go up over the machine, as the shovel runs under the row, and an endless chain runs up over and around the grate. The earth works out, and the potatoes are left absolutely on top. There is an arrangement for turning weeds and vines to one side, in the rear; but I know nothing about this. I took it off as soon as the machine got here. We don't raise weeds, neither on paper nor in practice. The vines are dead before we dig, and do no harm going over with the tubers. Now, this is for varieties we grow that do

not spread much in the soil. The machine would not dig the old Peachblows clean. We have dug an acre in two hours. with long rows and conditions all just right; but this is faster than the average. The machine is all iron, and I do not think it would answer for digging before potatoes are entirely ripe; but this I do not know from experience. I have found but one variety of potatoes that were injured, when ripe, by the digger; these were so soft and tender and large that it bruised them some, and we put a stick under the grate, on the axle, so as to stop all shaking, and with care dug them pretty well in this way, the soil being quite fine and mellow.

On level or moderately rolling land that is clean, free from stones, and fairly mellow, I can do a job that would do your eyes good--well, you may almost call it a perfect job, and still, once in a while I cut or bruise a tuber, but not nearly as many as I should by digging with a fork. You may call the work practically perfect. Of course, the machine has no business in a field full of large or fixed stones. With my stone-shields on I can go through any gravelly place, or through small stones, almost without trouble; but I would not advise the use of such costly machinery where all land is of this character. We have but little gravelly soil. In such the wear and risk would be too much. The machine is strong, and thoroughly well made; but if you do get a stone in, and bring four horses to a sudden stop, sooner or later you will break something, as you can see. I can not advise its use on a side hill that is at all steep, where rows run along the hillside. It will go straight up the hill all right, no matter how steep, and it will go down a moderately steep hill.

Now I have told you the whole truth. With this machine, and plenty of oil and gumption and power, and reasonable conditions and long rows, I can make ten experts stir themselves to keep up with me with a fork. If the men are just ordinary hands, not used to digging, and the soil is a little

hard and dry, 20 of them may get discouraged before night, if they agree to dig as much as I. This, of course, is for very long rows, where every thing is clear, and I can go right along steadily, and waste little time in turning. I made this statement at the Wisconsin Potato Institute, and some growers thought it too strong; but one man, who raises 100 acres, stood by me. I know what I am saying, because I watched what men did on neighboring farms last fall—men just picked up by the day. I could make a stronger statement than the above from what we did. I never feel quite as much as though a farmer is somebody as when on that digger, with soil in just about the right condition. Doing the work of 20 men! Why should I not feel important? And it costs me almost nothing. I do all the digging, with the aid of the horses, which would stand in the barn if I dug by hand, and nearly all I save is clear gain. And then, I am independent. I don't have to pay men, and beg them to come too. It is pretty hard to get men to dig potatoes here now, and it is as a sort of special favor to you if they come at all.

Now, where a man has other work for his horses at the time, the digger will not, of course, pay as well. If we were drawing to market with two teams, as we once did, I should not feel as big over my digger. That year, when we had nearly 7000 bushels, and my man dug them at a cost of one cent a bushel, and by straining every nerve we hardly got the crop all to market before winter, with all our horses, it would not have paid me to stop to dig with a machine. We were not ready for it then: we are now. I want to be fair, and give all sides. One more point about the digger: I don't want to lead you one inch out of the way by what I say. With the stone-shields on, the digger will of necessity clog up with earth some after a shower, when soil is moist. If there are no stones, take the shields off and you can go when quite wet; but then, a gravel hill may bother by furnishing little stones to drop into the chain. Now I believe you have

all the facts and the whole truth about the digger. Be sure you read carefully, and remember *all* I say, and then study out for yourself what is best for you.

CHAPTER XVII.

Storing, Sorting, and Sprouting.

As we are situated, storing over winter to sell in the spring is not wise, no matter how high they may promise to be. We believe in selling at the best price we can get in the fall. I have never seen a fall when I could not sell for a living profit. I have known prices to go down in the spring so a carload in the city would barely pay the freight. I will not take such risks. In the spring, it is now or never; in the fall, there is a long time before the new crop comes in, and ruinous breakdowns in price are not as likely to occur. Again, there is shrinkage, extra labor, interest on capital lying idle, danger from rot, frost, fire, etc., to take into account, where potatoes are kept over. And with us a more serious matter would be the marketing in the spring on soft roads, and when we ought to be at work at our farming. Do not imagine that the writer has not tried the wrong way as well as the better one, and lost by it. Those who are near good markets, where they can go in and retail their loads, may be able to sell partly in the spring to advantage. We are not all situated alike. *We* prefer our money to be in the bank before freezing weather. Again, one near enough to a station, where potatoes were bought for shipping, so he could move them in safely in very cold weather, when there was a scarcity in market, or who could load a refrigerator car and go with them to market, might make holding pay.

Growers must often store temporarily in the fall before they can market their crop. The simplest way is to put about 50 bushels in a round heap, and cover with straw deeply enough

to exclude all light, and carefully enough to shed all water. This can be done. We have had many piles thus covered in years past. Lay forkfuls around the base of the pile first; then a layer above and lapping down over the first, and so on up, placing a large forkful on top, and a little earth on it to hold it.

I once sold a carload of potatoes to a shipper, and it rained very hard when the car was about half loaded. He was much put out, as he thought we could do no more loading that day, and he was decidedly surprised when we opened a pile and showed him the tubers all dry as ever. If they are to be left in the field until there is danger of frost, throw a slight covering of earth over the straw. In this locality it is not safe to trust them under straw alone, much after the first week in October. I once lost a good many the 16th of October, where no earth had been put over the staw. Hard freezing as early as this is, of course, an exception; but we must look out for it. I know a grower who dug and piled a large quantity of potatoes, covering with straw all right and putting a heavy coat of earth on at the same time, and they all rotted down. Don't do this way. We have never had any trouble by handling potatoes carefully and having them reasonably dry when piled, and not putting earth over until they had been dug some time, and putting no more than 50 bushels together. Of course, if there were any rot among them we wouldn't store in this way. I think we had one year forty piles out in this shape. But a man who grows potatoes largely had better arrange as soon as he can to store under cover. It is less trouble. Let me relate a little experience that made this very clear to me:

Four hundred and fifty bushels were put in 9 piles, and 450 bushels were put into the cellar. After they were stored I turned off my men. Soon a buyer came and bought them all. I loaded them and drew them to market, and I was exceedingly glad when I got those piles all loaded. I could load quicker and easier from the cellar, every time. In the

field they had to be all handled with the fingers: in the cellar we could use a shovel. My son, then quite young, did the shoveling, and helped me lift the basket on my shoulder; and as the door was eight feet high I could walk right out without stooping. The boy liked it better in the cellar too; his fingers didn't get so dirty and cold, when shoveling, as when he was picking up. If the cellar had been about five feet and a half high, and the stairway poor, my testimony might have been different.

By the use of boxes, and as my cellar is arranged, I can put a carload into the cellar easier than in piles, when you take into account the covering of the piles; and then I have got through doing very much picking up, with cold fingers oftentimes, out of piles outdoors, when I can shovel them up under cover. We have a house cellar where we can put in 2000 bushels, on a pinch, and also a barn cellar that will hold 1000. But for storing large quantities temporarily we use the basement of our barn, which was built with this object in view. It saves bringing potatoes upstairs out of the cellar. We darken the windows by covering with building-paper, and pile the potatoes right on the earth floor from three to four feet deep. We have often had a solid pile of this kind about 11x60 feet. The barn cellar is on a level with the basement floor, and just as handy. As we are seldom able to sell by the car as soon as we can dig our early potatoes, we dig and put them right into the barn as fast as possible, and then when wanted they are ready, and meanwhile they are safe, and a buyer can see them. It is little trouble to store them; we can rush in a good many in a day with digger, boxes, and about three men besides myself. If they are sorted in the field (little ones not picked up) we can shovel them up in the barn when we sell, as the floor is quite smooth. This beats covering piles and outdoor picking-up in the late fall. If we want to save little ones—why, we pick up every thing after the machine, and then sort at our leisure in the warm barn, either letting in a little light, if

potatoes are for seed, or using a large lamp, if they are for eating. Many are afraid of piling up potatoes in this way early in the season. All I can say is, we have put in thousands and thousands of bushels, and never had any trouble. But for sprouting, I would not store any differently in the cellar to keep over winter. To cool them off and keep them so, it is necessary to have a temporary floor up six or eight inches to put them on, and then board partitions a few inches from the walls, to allow the cold air that you let in to settle and circulate under the pile. When they are right on the earth the natural warmth of the ground will keep the temperature higher than a large pile of early potatoes will stand without sprouting early. For seed, or for our own eating, I prefer to store in tight barrels and cover up, if the quantity is not too large, and these barrels should be up from the earth several inches, to allow of a free circulation of cold air underneath. When stored right on the earth in large piles, as we do in our barn, they will be wet, more or less, on top; but this does no harm unless there is disease in the tubers. It is a natural process. The warmth from the earth keeps the temperature of the pile up somewhat, and colder night (or day) air coming in over the surface causes the warmer air that rises from the tubers to deposit some of its moisture on the top potatoes. It is not "sweating," as some call it. If we open the doors and let a warm wind blow through, the top of the pile is quickly dried. If we open up in a very cold night (for fall) the top of the pile will be very wet in the morning. So when we take potatoes out of a cold cellar and market them on a warm day they will be as wet as though taken out of water. The warm air is chilled when it touches the cold potato, and can hold less moisture in suspension, and simply must leave it on the potato. These simple natural processes should be understood.

All light *must* be excluded from the cellar, unless potatoes are covered from it, or the eating quality will soon be ruined.

Light will turn them green so they are unfit for food, but it will not injure them for seed. A thermometer should always be kept in the cellar, so that you may know when to let in cold air and when there is danger from frost. An oil-stove is the thing to raise the temperature slightly, when it may be necessary. I met a good many farmers this last cold winter who lost potatoes in the cellar or pile. There is no business about such management. Bury them, as described in chapter 9, and they are safe. Buy a fifteen-cent thermometer and a little oil-stove, and tend to the matter, and they are safe in the cellar. I know one man, who is sadly in debt, who lost 82 bushels of Freeman potatoes last winter, the product of a barrel that cost him $15. I would have paid him $164 for the potatoes this spring.

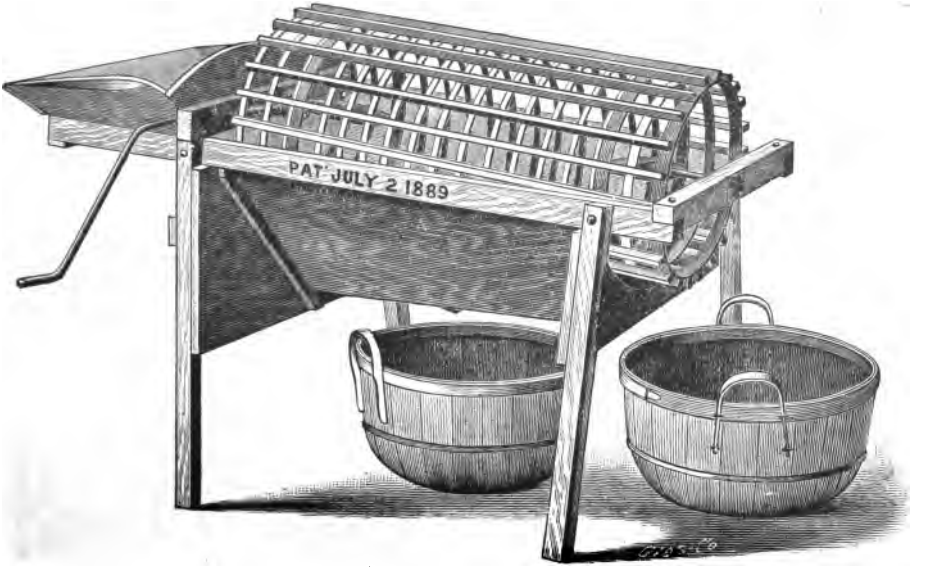
But now some will say it is not safe to store potatoes largely in a house cellar, where a family lives above. That depends. It is safe in our cellar. I would just as soon sleep down there when it is full of potatoes. Still, we do not intend to store there regularly, in large quantities, but we have it ready for an emergency. Our cellar is plastered overhead, and building-paper (air-tight) put all over the floors above, under the carpets. The draft of the stove can not draw any air out of the cellar through the floor, as it often does where less care is taken. Then we have a ventilating-flue running from the cellar to the top of the main chimney (43 feet from the cellar bottom), by the side of a flue that is always warm from being used for the heating-stove above. This warms the air in the ventilating-flue so as to create a draft that keeps the cellar all right; and an east window is open except in the coldest weather.

Sorting and Sprouting.

We tested a new variety for a seed company last year, and put the product, 90 bushels, into the cellar when we dug them, they agreeing to pay us $1.00 a bushel for them. They failed to keep their contract; and this morning, as the tubers

were beginning to sprout, we sorted them up and took them to town. They were early potatoes, and sprouts will start in the cellar by this time (Apr. 7). Some of them were an inch long. When we dug the potatoes they were not sorted at all, but picked up, little and big together, as we were to have 50 cents a bushel for the small ones. The season is forward, and we are full of business outdoors, and I dreaded this potato job; and, but for the Hoover sorter and sprouter, I should have dreaded it much more. For three of us to sit down and sprout and sort those 90 bushels by hand would be a job that I shouldn't like to take for a day's work. I have done such work, but I always dread it and avoid it when I can. Now I am ready to tell you how easy the machine made it for us. We put it in position, with the pile of potatoes at the hopper end, and room for working and piling boxes at the other end. Then my man Fred took up a big wooden shovel full (nearly a peck) and placed it on the hopper. I turned the crank with my right hand, and took hold of the shovel with my left, and fed slowly. My man filled another shovel and placed it, and took from me the empty one, and so on. At the other end my son Robert sat on a box, with a bushel box in front of him, and under the end of the sorter. His work was to watch for poor, rough, or cut large potatoes, as the box filled up. The sorter took out the small ones, and Robert moved the boxes back as they were filled, and placed others. In this way we were all busy. It was not hard for any one, and we kept a steady gait right along. A perfect job was done at the rate of 40 bushels an hour. Now, this is an exact fact by the watch. The potatoes were as well sprouted as one need ask for, and sorted too, with the overlooking by Robert. With four horses and our work outside waiting, that sorter was worth one-third its cost to us easily this morning.

We have, of course, some 20 bushels of eating-potatoes to sprout from this time on, as we always keep early ones to eat, they being of better quality. If the sprouts are left to



POTATO SORTER AND SPROUTER, MANUFACTURED BY HOOVER & PROUT, AVERY, O.

In regard to prices, they tell us $15.00 less discounts in unoccupied territory. Address the above for any further information.

grow long, the potatoes are injured; and they used to get left, for it was a job we all dreaded. Now it is fun. We can run them through the sprouter in 20 minutes, or less; and if sprouts are not allowed to get too long it will take them off nicely. If they get too long and tough, they do not break off well. It would pay me to keep a sprouter just to sprout what we eat. I dislike mean jobs, and to set my son and man at them; and as for letting my wife or daughters do it—well, they would if necessary, but I am glad to say it never is.

For sprouting only, one can run potatoes through very fast. He can sort faster than we did this morning; but we were taking time to do as perfect a job as possible. To do nice sorting one must turn very slowly, and not put in too many at once, and also block up the lower feet an inch or so. Properly managed, the sorter and sprouter will do all you can ask of it in the spring. But at digging-time in the fall, when the skins are not very tough, it bruises our potatoes too much. This may not be the case with all varieties and under all circumstances. I can tell only what I know. We sort by hand in the fall. There is no trouble about bruising in the spring. Of course, the sorter takes out all loose soil. I wanted to take the whole season for rewriting this book, and write of each point as we were at work in that line. It would make the matter more interesting. But the publishers could not wait. In this matter of sorting and sprouting I have been able to do as I wanted to—do the work in the morning and sit down and write in the afternoon just what we actually did.

CHAPTER XVIII.

Potato-Growing as a Specialty.

If the raising were confined to a smaller number of farms, and those who did raise them planted a good many and made a business of it, it seems to me, for several reasons, as though they would make more money, and there need be no loss to those who now raise an acre or two, if they should give up the business to those who go into it largely, for they can turn their attention more to some other special branch.

The day has passed when there is any necessity for such a diversity of crops—when it is necessary for a man to raise almost every thing he wants, on his own farm. It was necessary once, when the country was new, and there were no railroads or markets, and not much money; but now let it go, to a certain extent, along with the stage-coach and scythe, and let us improve in this respect as much as we have in our means of communication and in our agricultural implements.

When I speak of the potato-grower as a specialist I do not mean that he should grow just potatoes and nothing else, but, rather, that he should make that his leading crop—his main source of income. Other crops must be grown with them, of course, to make up a rotation.

Let me give some of the reasons why the large grower of potatoes, who makes this his chief business, can make more money. First, he can afford to have all the tools and contrivances that are made for saving labor, and taking the best care of the crop, and marketing it in nice shape, such as have been spoken of in previous chapters. The man who raises only two or three acres can not afford all these expensive labor-saving tools, and therefore can not make as much

money, for he can not put in or care for his crop as cheaply, nor can he market it in as nice shape. Again, the specialist can not only have the advantage of all the best tools, but, what is still more important, he can use them just when they ought to be used, as that is his business, and there is nothing else to interfere. With a great variety of crops to care for, and perhaps a dairy besides, this is often quite impossible. There are times, in this locality, when a single day's work with the whole farm force, each man with a cultivator and horse, just exactly at the right time, would be of very great advantage to the crop—possibly almost the making of it. The specialist can put in that day's work. Also the large grower has a chance to concentrate most of his energies and study in one direction, rather than scatter them thinly in many directions. Instead of being a jack at all trades, and particularly good at none, he can have a chance to excel in one direction. If he will improve that chance, and push his specialty to the utmost, he will find that it not only pays in dollars and cents, and develops his thinking faculties, and makes more of a man of him, but he will get rid of a great deal ot the worry, as well as loss, of having too many irons in the fire. Money is not the only thing to live for. But I do not advise a narrow specialty, or any particular plan. This chapter is written with the hope that it will set the reader to thinking and studying, not to give him any particular directions. Each farmer must arrange to suit his own local circumstances. On my farm, only wheat and potatoes are now raised to sell. We buy every thing we want, except potatoes, milk, a little garden stuff, and the berries from our fruit-garden. We do not fuss to make even our own butter, but use on berries the cream from our one cow, and otherwise. Of course, we raise our own hay for the horses and family cow; but we do not raise the oats for the driving-horses. There isn't a pig, a chicken, a calf, colt, nor sheep on our place; so you see I practice what I preach—or, rather, I am preaching what I have prac-

ticed for many years, and found to be the easiest way for me to make a good living, with the least worry, from my farm, and I find it the pleasantest way too. There is a pleasure about doing one's very best, as the specialist has a chance to do, and the profits from such work are larger. Could any man living support a medium-sized family, and live comfortably, pay his hired help liberally, and all other running expenses, and get ahead over a thousand dollars a year, actual cash saved, from 35 acres of plow land and 19 acres of poor pasture, by following ordinary mixed farming? I couldn't. I could hardly live, let alone getting ahead any. Thus I was forced to go into farming of a different character, or be poor all my life.

But I would not have you think that the specialty of itself will ever help you any. It will not. It only gives you the opportunity to excel—to do your level best—in one particular direction. Nor would I have you think that potato-growing is any better specialty than many others. It is not. An average crop of potatoes pays no better than an average crop of wheat or corn, for a term of years. If it did, every one would rush into the business and bring the price down. It is the big crop of potatoes or corn or wheat, or the big yield of milk, that pays. It does not make so much difference what the crop is, only so it suits your taste, soil, markets, and other local circumstances.

With 10 acres of land rightly situated, I think I could get quite independent by growing strawberries, like my friend M. Crawford. Again, I might keep a dairy on 50 or 100 acres, and make choice butter, and get $100 from a cow, as does C. P. Goodrich, of Wisconsin.

I think I speak within bounds when I say that the potato-specialist, who has soil and markets favorable, can, after he has had a reasonable amount of experience, make twice as much money out of the crop as the average farmer does who follows mixed farming and raises two or three acres each year. Then why shouldn't he do it, and buy other things he

may need? Because he is only a farmer must he be a drudge, and do a certain way whether it pays or not, just because his father did, or his grandfather, years ago when times were altogether different? Would he go to New York in a stage-coach now, in preference to a palace car, just because his father used to do so? If I, making a business of it, and having soil suitable to the crop, can make money growing potatoes, and A, with a clay farm and a good spring, can make money making fancy butter and raising choice pigs on the skimmed milk, why isn't it a sound business policy for him to buy his potatoes of me, and for me to buy his butter and pork? We are both gainers by the operation. Why must he fuss with an acre or two of potatoes, on soil unsuitable, and in which there is no profit, when he could spend his time pushing his specialties, and make a profit by it? Just because father did so, and he knew, I suppose, or on account of the old saying, "You mustn't have your eggs all in one basket." But those words do not scare me at all. That saying belongs to the days when Ohio was the "Far West," and it took almost all summer to go out there and back. If a man raised too much of one thing then, he was in a bad fix on account of the poor facilities for exchanging, and the lack of markets and the scarcity of money. But, how different it is now! The whole world is one market to-day. We can sell almost any thing for cash, and with the cash we can buy almost any thing we want, right at our doors.

All this, friends, is no theory at all with us. We have done this way some twenty years as a matter of business. From having potatoes just barely pay cost of production, as they usually do, finding them well suited to most of our soil, we have worked in that line until we made them pay 100 or even 200 per cent profit, and then bought other things we could raise on the farm, but would pay little or no profit, where we fussed with them in a small way. I hope you get the point. For example, dairying is a good business if fol-

lowed as I do potato-growing; but there would be no profit whatever in our making butter from two or three cows, if the labor of my wife were counted, as it is with me. She would have to go through with all the operations of dairying every day in the year, the same as though enough were being done to amount to something; and then, could she afford the best implements and conveniences? could she have ice and the separator, and the Babcock tester, and a power churn and worker, etc.? Of course, not. Then why not extend and push our potato and wheat growing, and drop the dairying entirely, and let some one else extend and push that? That is business. That is sensible. That is what we did some twenty years ago. That is what has paid us.

I have in mind a man who is now working very much as we did when we first came on the farm. He has cows and young cattle, and pigs and chickens, and raises, or tries to, every thing he needs for himself and stock that will grow on his place. At any rate, it looks so to me. He and his family work very hard early and late, and have for many years, and they just barely live, as he has told me. Every year they put in two or three acres of potatoes. The soil is not suitable for them at all. They plow out the furrows with a one-horse plow, the father holding while the son leads the horse. Then they drop them by hand and cover with a hoe. When the weeds get to show green all over the field they cultivate up what they can between the rows, and day after day work hard to hoe out those in the hills. Often the clay soil dries and bakes after a shower because they are so driven with work that it is impossible to tend to any thing on time. Well, they get through some way, and dig them out by hand, late, in the mud; and labor, interest, and seed, fairly paid for, would have bought more than they harvest. This picture is not overdrawn in the least. Now, friends, you may talk against specialties all you please; here are the facts: That man is growing poorer and poorer growing potatoes, while we are making money right along. He has no business

to plant a single one. If all his efforts were concentrated on his cows, and food to keep them, he might soon be independent. At any rate, he would have a chance to be. Now he has no possible chance. If he makes a little something in some line it is overbalanced by losses on something he should not have fussed with. We have been just as poor, and worked just as hard, and just so contrary to sound business principles. Little by little we found out better.

As said before, no narrow specialty should be followed. We need a rotation and steady employment. It will not do to raise patatoes only, year after year. Specialty farming is sound and sensible; but it has its limits. It must not be carried too far. In the next chapter we will try to show just how far it can be safely and profitably carried.

CHAPTER XIX.

Rotation and Clover.

You all know, of course, why a rotation of crops is needed; why we can not to advantage grow potatoes right along year after year on the same ground. The land gets tired of growing one crop only. The ingredients used by it become exhausted, or some of them do, and then enemies to the crop increase greatly when it is grown continuously without change. A short rotation, where each crop occupies the ground but a single year, helps greatly about warding off damage by all the various pests. They hardly have a chance to get a foothold before their feeding-ground is torn up, and perhaps a crop put in that they do not like. Such troubles as the scab and blight are doubtless made worse by growing crop after crop on the same land. But a great advantage that comes to us from rotation is the chance it gives us to bring in what is called a renovating crop once in from three to five years. A renovating crop is one that gathers up fertility and leaves the soil richer than it was before, in available fertility. Clover is our most practical plant for this purpose in this locality, and over a large part of the country.

There are many thousands of farms in this country where far greater prosperity would come from systematic attention to this matter of rotation and clover-growing, whether potatoes are grown or not. In the far East they grow grass (some clover in it perhaps) too exclusively oftentimes. Land is left seeded, and mowed till it hardly pays for the labor. In the West there has been too much continuous grain-growing and too little seeding down. And, again, in traveling thousands of miles both east and west, month after month, I could not help noticing that most fields are seeded with timothy and comparatively few with clover. Well, it

is a change and rest to seed down with timothy. It is rotation, but not renovation in the slightest degree. Timothy feeds on the soil exactly as wheat and corn and potatoes do, and leaves it just so much poorer. Timothy *eats* nitrogen, as the *Rural New-Yorker* lately put it, while clover *gathers* it.

Now, clover in regular rotation, in the place of timothy, if you do your part, and on any soil where it is reasonably at home, will do just this: It will give you about twice as many tons of hay per acre, if you want feed; it is worth about one-third more per ton to feed out, and about one-third more as a fertilizer. Or, if you take into account the fact that there is twice as much of it, the clover is worth three times as much as a fertilizer per acre as the timothy, above ground, without counting the roots. The roots are also worth far more than the timothy roots, as a fertilizer. Now the question comes up that is all important—Where does the clover get this excess of fertility? If from the soil directly, as does the timothy, then we gain nothing in the end, as we are only running our land down faster. But at last it is known that this is not a fact. The clover has the ability to absorb, through a peculiar growth on its roots, free nitrogen from the air. At market rates for nitrogen, there is in the air resting on a square rod of your farm more than $97,000 worth. We need not worry about the supply giving out, you see.

Of course, clover can get no mineral matter from the air. It must get that from the earth, as other crops do; but there is this difference: Clover is a deep feeder. It sends its roots down far, and gathers up and brings to the surface. Perhaps it gets what naturally exists in the subsoil, but it also lays hold of what is constantly leaching down with the water of heavy rains, and what has got below the reach of more surface-feeding plants. It gathers up escaping nitrates as well as mineral matter, and practically all comes to the surface again, where other crops can get it when you plow the sod under. But let me stop right here to say it does not

lie there long. You must get something else to growing at once to eat up the stored fertility, or it will get away from you. Nature does not wait long. In another chapter I wrote of sowing wheat thickly on half an acre of stubble land last fall, that would otherwise lie bare all winter. Well, we have plowed it lately, the wheat being about a foot high and as thick as it could well grow. The sod was very heavy and tough. If we had left that land bare from October till May, the fertility that fed that wheat would largely have leached down beyond the reach of my potatoes this year. The clover that would be sown there in a year or two would pump it up again, more or less of it; but as it is, I get it *now*. Further, clover has done its best in the way of drawing from air and subsoil at the end of two seasons' growth (one with the grain it was sown with). To make the most of it as a renovating crop, one needs to turn it under then, or in the spring following, and turn the accumulated fertility into money by putting in some suitable crop. Here is where many fail. They let the clover grow along and run out, and much of the work done by the clover is lost.

I might speak of the benefit that comes from shading the ground by having it densely covered with clover, practically all the time for two seasons. I can not give it to you in dollars and cents, but it is working in accordance with nature's law, that covered shaded land grows richer, and large profit will come from it.

This is a great subject, to which a whole book of this size could well be devoted, and I can, in a single chapter, only touch the matter here and there in a way, perhaps, to set you to investigating. Let me briefly put figures to some of my first statements.

My land will grow about 2½ tons of timothy hay per acre, in one cutting, and usually there is not much aftermath. In clear clover (the common variety) it will grow not less than 1½ tons (dry) per acre after the wheat is removed in the summer. We have often had two tons. This we clip off

twice with the mower, and leave all on the surface to shade and enrich, and thus all going to seed of weeds is prevented. The first crop the next season we cut for hay, and it will, I think, never fall below two tons per acre. It is more apt to be three tons, but I do not want to exaggerate in the least. The second crop, which is left on the surface to plow under in the spring for potatoes, we will call 1½ tons per acre, although it is more often two. Now, at these lowest figures we produce 5 tons per acre of dry clover, in the rotation, and while the timothy would give but about half as much. All of this could be saved for hay, and have twice as much to feed out as of timothy. We once did this. Science tells us that this clover hay, cut when in full bloom, and well cured, is worth about a third more to feed than timothy. Having fed it for many years I can say this is also true in practice, for cows and horses and young cattle. I certainly have $1000 in cash to show for what I have saved on horse-feed by using clover instead of timothy—the value of grain actually saved, while the horses did just as well. Now as to the fertilizing properties:

A ton of timothy hay is worth as a fertilizer, on a basis of market rates of nitrogen, phosphoric acid, and potash, $5.48; a ton of clover, $8.20. This is from the highest authorities in the land. It is essentially correct, just as certainly as that 2 and 2 make 4.

Let us now put these figures together and see what they mean, assuming that the root-growth of timothy and clover is worth about the same per ton dry as the top growth, which is not far from right. Two tons and a half of timothy hay per acre, and we will say 2½ tons of dried roots and stubble (this last I think too high, however), would be worth as a fertilizer, at market rates, $27.40. This I would get by growing timothy. Some would be wasted by feeding out, even on tight floors and with every care, but so would some of the clover, and we must not stop to carry the matter to the end. Five tons of clover hay per acre and three tons of

dried roots (about right for our crop) would be worth, on the same basis, $65.60. I said the clover above ground would be worth about three times as much as the timothy, as a fertilizer; 2½ tons timothy would be worth $13.70; 5 tons of clover would be $41. Do you see?

Now, in the light of these figures do you want the $27.40 or the $65.60? You can take your choice; and, if you help yourself all you can by choosing the $65.60, you can have twice as much hay to feed, and hay worth about one-third more per ton—that is, on suitable land. In this chapter you can find to a great extent the foundation (next to draining) of our little success. I tell you in all seriousness, that this is not theory. We have proven science to be right, or rather, I may say, science has to a certain extent proven us right; for long before it was shown that clover could draw nitrogen from the air, the writer, from his experience, insisted that it must be so. Some eight years ago Prof. Henry said to me: "I believe you are right, but I can not prove it." Now it is proven. We have taken a farm that was badly run down, and made clover pump up and draw down a good many thousand dollars for us. As yet it has found mineral matter enough. Some time it may need to have that applied. Prof. Roberts, of Cornell, said to me last winter: "You have solved the nitrogen question." I think so; and that is the most serious, because most costly. In the East, mineral matter, particularly potash, is needed now with the clover, or, rather, to enable the clover to do its best. Now you may see more clearly why we use our manure on the young clover, the renovating crop, or the wisdom of so doing. With that $65 worth, more or less, of fertility per acre, we are all right; don't you see? If the manure can help us to get it, why, that is the way to use it. It makes the clover stronger to pump up and draw down from a supply beyond the reach of ordinary crops.

Now you may see why fertilizers show no results on my clover land. On an acre, the clover furnishes fertility equal

to about one and a half tons of Mapes complete patato-manure, costing (this year) $41 per ton, and I have got it without any loss of use of the land for a crop, and at almost no cost—only care and attention. I believe I haven't told you that, since writing about fertilizers, I have bought 1400 pounds of Mapes potato-manure, to use in experiments on an acre of ground, this year. (The publishers calling for this book a few chapters at a time, as fast as written, makes it quite possible I may repeat some things, from not having the manuscript all before me. If so, you will know the reason.) Now, in the light of the above figures you can see why Mr. Mapes wrote me that it would seem almost like carrying coals to Newcastle to put fertilizer on my clover land. It will probably so turn out, as it always has; but I want to know this, and am intending to use a large amount, you see.

There are many points I should like to speak of about clover, that have been jumped over. Here is one: I said timothy feeds in the soil directly, etc. Notice the timothy sod, or the red-top or blue-grass sod, or a wheat or rye sod, for that matter. If a heavy growth, the *soil* is full of roots, enough to hold it together as you turn it over, and it takes an implement like the cutaway harrow to make a seed-bed. Now notice the growth of clover roots. The tap-root goes right down through the *soil*, taking only enough to support it till it gets down. Then it sends out its fibrous roots, far and deep, to gather up fertility, which is stored in the large tap-root, near the surface and in the top. When I plow a good clover sod, on any reasonable soil, it all falls to pieces, mostly from the absence of fibrous roots. The Thomas smoothing-harrow will take hold of it nicely, if not too dry. The clover has practically given the *soil* a rest, and shaded it. If you will drain land that needs it, and then grow clover systematically, and help it all you can, in many cases it will just put one more farm right into yours. Without any more plowing or working, or seed, taxes, or labor, to speak of, you

may draw on the farm down below, that now lies idle and useless, like coal in the mine waiting for man to use it. On my own farm, former owners had to scrimp to get along, while thousands of dollars that I have easily pumped up were lying within three feet of the surface.

My Rotation.

After many changes I have settled on a three-year rotation, of clover, potatoes, and wheat. This is the best I can study up for our circumstances. No stock is kept, further than our horses and family cow. We have at present a work team; another team, one of which is a good driver, and a road-horse that wife can drive, and a pony that belongs to our son. For several years we have kept no more stock than this, and grew only potatoes and wheat. We cut just what clover we want to feed out. As we feed horses in the barn most of the vear, this takes considerable — about all of the first crop of clover. The clover that grows after the wheat is removed is clipped, and left to go back to the land and feed the potatoes directly. Meanwhile it shades the ground and thus enriches it. We usually mow it twice, when it is from 8 to 12 inches high.

The first crop the next season is mostly cut for hay, early. The second crop we harrow down with the Thomas harrow, when about knee-high, just before it falls down, in lands, the way we will plow in the spring. Thus it plows under easier, covers the surface more evenly, and it is prevented from ripening as quickly. It continues to grow much longer (more fertility gathered), as it tries to grow up again and form seed, the object of its existence. I think I make it grow a month longer by this breaking flat down. It is best done when wet with dew. This clover is not plowed under till spring, you will notice; more shading, and live roots in the soil to prevent waste, and no surface-wash. No animals are allowed to pasture on the clover at any time during the rotation. We

can not afford to tramp the land. We have a permanent pasture for cow and horses. We might (and do some years) save the seed from the second-crop clover, putting the haulm back to plow under. At present prices it might pay. At $4.00 or $5.00 a bushel it did not. It was worth more to have the shade of the clover on the surface, and some to plow under on every square foot of surface, for a crop that brought me as much money as potatoes do, than it was to save for seed. We could never spread the haulm back evenly over all the land it grew on. And then the clover would die and stop its food-gathering at least a month sooner. This is for potatoes, you remember, with a crop worth from $80 to $120 or more per acre. I could afford to feed them well. It does not follow at all, that one could afford to sacrifice the seed for corn, that brings much less per acre.

Now, this is the way we have been farming for some time. What we have done has paid. We have had a good income, and were not overworked. There has been enough to do during the eight months from April 1st to December 1st, and still not so much that we could not attend to our fruit-garden and lawn and flowers, and have a reasonable amount of time—yes, quite a little of it—for recreation. Myself and one good man could do most of this, if I should work as hard as I once did. But I do not pitch right in now, except at times; and my son, and a man for about seven months, do the most of the work. We have to hurry rather more than I like, to get potatoes off, ground fitted, and wheat in on time. However, if the weather is good we can do it. We have done it with medium late potatoes, but intend to keep to moderately early ones after this. There is no better preparation for wheat than working the land all summer in potatoes, unless the fall is very dry. In effect, we plow in the spring for wheat, and work it all summer (the old summer fallow), incidentally growing a crop of potatoes meanwhile—a profitable way of summer fallowing, and just about as good for the wheat. The potatoes draw largely on the potash in the soil,

and the wheat on the phosphoric acid; and thus between them they keep a fair balance.

This is a good rotation—one that I can not improve on, perhaps, for our circumstances; and still there is just a possibility that I am growing clover too much. I see no trouble as yet; but you notice clover is growing on the land two seasons out of three—one in the wheat. This may be too much. A four-year rotation might be better: under some circumstances it would be.

Now, of course, if one had some rough permanent pasture he might keep sheep, say, or young cattle, that would not take up his time in the summer; cut and cure all the clover that we let go back to the soil directly, and thus have some work to do in the winter. If he will tend to the potatoes, etc., most thoroughly, and keep the farm all up in nice shape, and every thing in perfect repair, he will never lack for work. Some think that, with so few crops, there would not be enough to do. Well, ask my hired man. It is doing a few things thoroughly well that will pay in the future: half doing a great many things never will any more. The world is running over full of ordinary—plenty of room for experts, however, in any line.

Rotation for a Dairy Farm.

Potato-growing and dairying will go fairly well together, under some circumstances—say when there is a father and a grown son, one of whom can take charge of the dairying and the other of the crops. This will give a chance for an excellent four-year rotation. It would be this:

1. Clover manured for corn.
2. Corn for the silo, followed by rye.
3. Potatoes on the rye sod.
4. Wheat seeded with clover, and perhaps a little timothy.

In this case I would still use some manure, what might be needed, on the young clover after taking off the wheat, as advised in chapter 2. This would be a perfectly safe rota-

tion, and a good one. I would cut all clover for hay in this case. Clover hay cut early, and good corn ensilage, make a ration for cows that is almost perfect, needing only the addition of a little wheat bran and oilmeal or cotton-seed meal. The rye would prevent waste of fertility from the corn stubble. The potatoes would have old fertility, which is so much better than fresh manure. Corn loves fresh manure. The wheat would give straw for bedding the cows. I would not advise, as a rule, the growing of any more crops than those named. If oats are wanted, better buy them, where wheat does well. (Of course, this rotation will not do for *all* localities.) Give all your attention to the cows and potatoes, rather than undertake more. I know a dairyman who had seen that I was making money out of potatoes, as was he out of his work. But I think he was then undertaking too much, and would have done better to try to do less rather than more. But he did not seem to see any reason why he could not grow potatoes too, on top of all he was doing, and succeed as well as I. He tried it. He has had some heavy and almost total losses of crop to endure. To be sure, if the season had been just right, so he need lose hardly a day, he might have done fairly well; but it isn't often so, and we must take these matters as we find them, and fit our work accordingly by not undertaking too much.

Of course, you see where the weak place in this rotation is. The digging of potatoes, getttng in wheat, and cutting ensilage, come too much in a heap, or would in a wet fall; but it could be managed fairly well, as a rule, with a little extra help. Putting in the two crops would not clash, as early potatoes should be planted first; and the help that was needed on a dairy farm could care for both. The corn can be grown for grain, on a farm where a dairy is not kept, and the rotation will be an excellent one just the same—in fact, as good as I know of. In both the rotations given, there is the minimum of danger from such pests as the Hessian fly, wireworm, white grub, scab, and the numerous troubles that

the crops named suffer. Oh, yes! that reminds me that I promised to tell you about getting rid of the ravages of the white grub, or how not to have them. This short rotation, one year in a crop, is a part of the plan. The rest is, to have such heavy crops of clover, so thick, and shading the ground so thoroughly, that the May-beetle that lays the eggs will not be fool enough to deposit them in such a cold dark place, where they would never hatch, but will fly away to some thinner sod somewhere else. She will lay some eggs in thin wheat, I find, or perhaps in good wheat, but not to any great extent. When we find a few grub-eaten potatoes, it is, as a rule, if not always, where there was a thinnish spot in the clover. A little more manure on such spots, where clover is young, is the best remedy. You know I told you that nature is down on the underling. It is no use to spend time growling about this. You can't change the law. Don't have any thin clover, and then practically no grubs and more dollars; for, just as sure is the other law, that "unto him that hath, shall be given."

Of course, in both rotations, the ground is not plowed for the wheat, but made mellow and fine on the surface, with cutaway, Thomas, and roller. This is all right except in a very dry fall, when potato-stubble is almost too dry for wheat to do well. Old readers will notice that the rotations given in this edition are quite different from those of the original book. They are decidedly better, rest assured. I was about to change at that time, and was quite certain that it was for the better; but I thought best to try it before telling of it. Potatoes two years in succession, or clover, is not a wise plan. The great gain in my present rotation is in giving clover a better chance to help me, and turning its gathered store of fertility into more money. Again, I use timothy less. Indeed, for some years I haven't sown any until this spring. Clover must have a good chance. I want that $65.00 an acre, or near it, not $27.00. I sowed a little timothy this spring when I did my clover, about March 1. The

field is partly clay, and timothy will do well in some spots when clover does not do its best; and with spring sowing, timothy will not get started so as to injure the growth of clover materially. I sow about six quarts of clover seed per acre, and always very early. I have not had a failure to "catch" in 24 years. I might tell you that a crop of 200 bushels of potatoes per acre takes from the soil $12.12 worth of fertility, at market rates; 33½ bushels of wheat per acre takes $7.09 worth of fertility from each acre. Say I sell off in the three-year rotation, then, $19.21 worth per acre. Compare this with what clover furnishes. It takes some to grow the vines, of course, and all the food furnished can not ever be used in one season; but isn't there quite a margin? What I am trying again this season to find out is whether any more fertility can be added in the shape of fertilizers so as to pay.

I may add now, that, since the above was written, we have planted the crop and used the fertilizer. In round numbers we put at the rate of 500, 1000, and 1500 pounds per acre, on plots containing four long rows each. We tried this on our best land, where there was at least two tons of clover hay besides a great growth of roots plowed under. This was selected, extra choice soil. It is good for 150 to 300 bushels of potatoes per acre, without fertilizer, owing to the season. Again, we selected the poorest land on the farm, where the growth of clover was, of course, lighter, and used on the same number of plots the same quantities of fertilizer. Some of these experiments were duplicated still again. Every care possible was taken to get every thing just right. For example, it would be no accurate test to put in one row, or two, with fertilizer. Rows each side might steal from it or them. With four rows in a plot we will dig and count only the two in the center, which will be exactly fair. I was putting on fertilizer broadcast, with my Empire grain-drill, when it occurred to me that the extra tillage from going over the land with drill might have some effect. I thought just in

time, and we have four rows where the drill was used and no fertilizer, and the two center rows will give us the average of unfertilized plot, treated in exactly the same way. These experiments will cost us at least $50.00 in fertilizer and labor; but I want to know the truth. If I have said too much against fertilizers in chapter 2, I am ready to speak more favorably when the facts warrant it. If I get no gain this year again, why, this clover question will seem still more important.

CHAPTER XX.

Cost of Production, and Profits.

In figuring the profits on any crop, farmers sometimes fail to figure their own time as worth any thing, and perhaps they throw in the use of the land also, and thus they make a fair showing for the crop, as they charge it only with actual cash paid out. But, how is the proper way? Your crop should be charged at least six per cent interest on the value of the land, a fair price for all labor put on it, your own, or that of hired help, or of your children, cost of seed and of manure, and a fair price for the use of team and tools — a price that will pay you at least ten per cent on their cost, over and above keeping. After all of these are deducted, then one can begin to talk about net profits. "Figured in that way, no farming would pay," some one says. I can't help it; that is the only business-like way; and if your farming won't stand it, it needs overhauling and improving. Now let us figure a little on an average acre of potatoes in Ohio—the cost of production, and profits, and figure fairly, no matter where it hits. The Agricultural Report for 1883, in a foot-note on page 405, says: "It was an excellent year, and potatoes yielded about $35.00 per acre" ($34.60 to be exact). We will take this as an average, although it was an excellent year—the best I have had since I began raising potatoes, for large yield. The average yield per acre for the State was about 99 bushels. This would make the average price about 35 cents. Now, what is the average cost of production? That is not so easy to get at. I have a letter before me from a farmer who says he raises about 100 bushels per acre in a good season, and cultivates about the way his father did before him—hasn't invested in any new-fangled tools or ideas—and he tells me about how he manages. Perhaps we

can get a little light from his letter. He says: "I plow the ground, and harrow it once with a common harrow, mark out with a plow, and cover with a hoe. Then I cultivate generally twice, going twice in a row each time" (he has got advanced enough so he drills his crop in, but not properly, or he would not need to go twice in a row), "and hoe by hand; then shovel-plow them, and hoe again, and that is all the tillage done. I put on about ten big loads of rotten manure on an acre."

On my farm it costs about $3.00 a day for man and team and tools for plowing and harrowing, and $2.50, say, for cultivating, and we will allow that our friend cultivates about as much in a day as we do, which isn't at all certain. He uses Paris green, and says it would cost him about $5.00 an acre if he hired a man to put it on, which he doesn't—can't afford it. A good man and board will cost, say, $1.50 a day to do the hoeing, and when we used to hoe by hand it took a man about a day to hoe an acre nicely. Now we are ready for figures.

Plowing one acre	$1 50
Harrowing with common harrow	30
Cultivating twice, twice in a row, and shovel-plowing	2 10
Hoeing twice by hand	3 00
Marking out with plow	42
Covering with hoe	1 50
Seed—small potato—16 bush. at 20 cts., one in a place, uncut	3 20
Dropping seed	1 50
10 loads of manure, say $1.00 per load, and charge half to this crop	5 00
Bugging	5 00
Digging and picking up	6 00
Marketing, say three miles	3 00
Value of land, say $100 an acre, use at 6 per cent	6 00
	$38 02

This makes the net profit $3.00 less than nothing.

I do not think the growers who work about in this way and with these results make any real profit as a rule. They

get some income, of course, and perhaps do as well as they would at any thing else. There are towns where potatoes are grown largely, where I know the average crop is not larger than the one given above, although in some cases the methods may be more advanced. The above is from the original edition of this book, and I see no reason for changing it, only that the figures for labor are almost too low. Digging, plowing, cultivating, etc., would probably cost decidedly more on the farm named.

Now let us figure a little on the cost of growing an acre on the farm of a potato-specialist, or of one who grows the crop in a large way, and does his level best all through. He selects proper soil, drains where needed, puts the manure on in the best way, follows a good rotation, getting all the benefit he can from clover-growing, prepares the land in the best way, plants the best of seed, properly cut, and, before they have sprouted, owns a planter, or, better, machinery for putting them in, and a smoothing-harrow and weeder, and has bushel boxes and spring wagons; in fact, he does every thing from beginning to end in the best known way. Here are the figures for planting on mellow clover sod:

Plowing	$2 00
Harrowing with Thomas and three horses	33
Rolling	25
8 bushels seed at 50 cents, average	4 00
Cutting to one eye	1 50
Planting with planter	1 00
Harrowing three times with Thomas	45
Harrowing four times with weeder	80
Cultivating, say eight times, once in a row	3 36
Bugs	2 00
Hand pulling or cutting weeds	75
Digging with Hoover and four horses	2 50
Picking up and storing	3 00
Marketing, say three miles	6 00
Manure, say same as before	5 00
Interest on value of land	6 00
	$38 04

Of course, these figures are not exact, and will vary some from year to year; but they are as nearly right as I can tell you; and you notice it does not cost the specialist, who has arranged to reduce the cost of production, and who does all he can to make a crop, any more to speak of than it costs the average grower. In regard to the above figures I will say that I have many times plowed two acres a day, of clover sod, deep at that, so it would cost but $1.50 an acre. I figure the harrowing, rolling, and cultivating at just what it costs us; that is, just the time we are in the habit of spending on the job. I have put the seed pretty high to pay for the labor of burying it. If we used our plows for marking out, instead of the planter, it would cost us about $1.50 an acre more to drop the seed by hand; but we should save enough seed, and get enough better yield to pay us several times over. I have charged full price for use of horses with digger, and enough to cover interest and wear on that as well as on the planter. This is more than fair; for, if we dug by hand, the horses would be standing in the barn. Interest on land may be too high for some localities; but any good clear potato-land here ought to be worth $100 an acre. I do not say the *farm* is worth that, as a whole; but the nice clean field that is good potato soil. If you think this is too high, then notice I have not charged for storage room or for use of bushel boxes. I have figured, for some years, that, leaving out manure, we could grow potatoes and put them on the track, 2½ miles away, directly from the field, for about $30 an acre, and come out whole.

Let us now go back to that year, 1883, when the average crop brought about $35 an acre and gave no profit, to amount to any thing at least. In such a year as that, an acre treated as we have figured ought to yield 250 bushels of fine potatoes that would sell for at least 5 cents above market price. That would be 40 cents a bushel for that year, or $100 an acre. Well, we got 40 cents that season for nearly all of ours, and had decidedly more than 250 bushels per acre, on 24

acres. But $100 per acre would certainly show a net profit of $60 per acre, not charging for the headwork of the manager. I think we actually did make about 200 per cent profit that year on the cost of production. But suppose one gets but 200 bushels, he still has more than 100 per cent profit, which is good enough—don't you think so? In such a year as 1881, when we were making so much, I actually felt as though it was wrong to take the market price for our crop, and I did sell to neighbors for less than regular market rates. With a net profit of $100 per acre I could not take full price from individuals, even if they did have the same chance to grow a paying crop that I did, and failed to make full use of it.

Now, friends, please compare these two sets of figures, and learn the lesson they try to teach. Do not do it with a spirit of criticism, or trying to find fault with them. They will not be exactly right, of course, under all conditions; but the general verdict they give is as true and trustworthy as the gospel of Christ. You may say 1883 was a wonderfully good season. So it was—the best one we have ever experienced; but others had the same season, and averaged but $35 per acre. The year 1881, when we made a still larger profit, on part of our land at least, was the poorest one for potatoes, perhaps, that Ohio has seen in a lifetime. Would that you could be made to see that average crops, managed in average ways, no longer pay any profit; nor will they ever again. Two things the successful farmer of the future must do: He must get larger returns per acre than the average, and reduce the cost of production. If you will think the matter over you will see that every thing that is said in this book comes under these two heads. Let us look at this a moment. If you drain the wet places, you will get more per acre. The clover rotation gives you cheaper and safer food, and hence reduces the cost of production. Cutting to one eye saves us money (seed), and is managed so as to give as good results. Drill culture and long straight rows enable us to cultivate at about half the cost. Level culture saves plant-food and

moisture, and shallow culture prevents injury to roots, all of which tends to increase the yield, and decidedly too. Good sound unsprouted seed, you will remember, once gave me $33 an acre more than sprouted seed. With our bushel boxes and wagons we can handle the crop for about half what we used to. Thus we have reduced the cost of production, you see. So I might go on for many pages; but, enough. You see the point, and it is the most sincere hope of the writer that you may get hints and be set to thinking by what you have read in these pages, and that the ultimate result may be large fine crops, produced at a minimum cost. Then will you be prosperous. I feel that, perhaps, I have made it appear that prosperity will come very easily. This is not often the case. It took many years of hard work to get our little farm fixed to suit us; in fact, it isn't quite right yet. It is a long hard struggle to double the productiveness of a run-down farm, and arrange to do every thing cheaply and as well as you can study out how. Success will come; but it is faithful, persistent, long continued, never-tiring, well-directed work that brings it.

Of course, there are localities distant from market where one can not make the profits I have figured. In some places potatoes seldom bring, in a good season, more than 25 cents a bushel. With 250 bushels per acre, and cheap clover fertilizing, one might even then make nearly 100 per cent net profit, if near a railroad station. If the price is too low, he had better raise something more concentrated to sell, like butter, so the freight will eat up less of the gross receipts. Butter is the best article to sell, because a ton of it contains but 48 cents' worth of fertility. Potatoes stand high also, removing only $2.02 worth in a ton, at market prices, while wheat takes $7.09, and timothy hay $5.48. It is a great point in favor of potato-growing, that it takes so little out of the soil, comparatively, except water. For example, you sell 100 bushels of potatoes at present price here, 75 cts., and you get $75.00, and remove from your farm but $6.06

worth of fertility. Sell 100 bushels of wheat at present price, and you get $75.00, so but $21.27 leaves the farm. Sell 7½ tons of timothy hay for $75, and $41.10 leaves the farm in fertility. At 25 cents a bushel, you see you sell far less fertility than in selling hay at $10 a ton.

I have now gone over the whole subject, and this chapter closes our little book, unless friend Root delays the publishing so that I can get in a final chapter, giving the substance of this year's experience.

The writer has tried to encourage you to do your very best, and to think and study; and, more than all, has he tried not to mislead you on any point. Please read very carefully, and be sure you carry out fully every little particular, if you undertake to change to some new practice.

CHAPTER XXI.

Experience in 1893.

PLOWING.

You have read what I said in the spring about plowing so as to keep land level, and avoid all dead-furrows; about plowing a field 16 rods wide all in one land, even if I did waste (?) some time going "empty" across the ends.* To show you that I know what I am talking about, I give the result. The potatoes in that field bring us just about $7.00 per row. Had we plowed in three lands, and had two dead-furrows, we should have been short two rows of potatoes, or $14, which would more than pay for plowing the entire field. The little time that, hastily speaking, you might say was wasted when drawing the plow across the ends, was really so invested as to bring a tremendous profit, and then the field looked so nice—one even, unbroken crop! By the way, we took up the old original rail fence between this field and that of our next neighbor, last fall, and built, in place of it, a neat, strong, oak board fence, thus getting ground for one more row of pototoes. This looked very much nicer; and then that row of potatoes ($7.00) would more than pay 10 per cent interest on the entire cost of the fence for one year.

SOIL.

We have had an excessively dry season. On our land that is naturally well fitted for potato-growing we had more than twice as many potatoes per acre as on clay soil, which is not suitable for the crop. With just rain enough, coming gently and never too hard, and coming often, our clay spots would do pretty well. Again, our season started with a great storm, lasting nearly three days, soon after we had planted our potatoes. This caused much of the seed to rot on the

*See publisher's appendix in the latter part of this book.

clay. We did not lose one single hill on naturally drained land; but seed rotted right over tiles during the extreme wet on clay soil. This rarely occurs; but if making a business of growing potatoes, I would buy suitable soil rather than take a clay farm as a gift. I am more than ever certain that it is wisest to use land to grow only the crops it is best adapted to.

DRAINING.

Although the seed rotted on some of our heavy drained land, causing us a loss of about $100, one drained low place came to the front wonderfully. It is a depression, or hollow, of about one-fourth of an acre, in a field of natural potato soil, which hollow has no natural outlet. For many years we endured the loss in this hole, as the cost of draining in the ordinary way would be excessive. At last we drained it by laying a main of four-inch tiles right into a gravel hill about 100 feet, and having no outlet. Then we put in numerous side drains to collect the water rapidly. It took $10 worth of tiles. We did the work ourselves. Friend Root was here just before the potatoes came up, and feared the seed had rotted; but it did not; and for the first time since we came here, a quarter of a century ago, we had a full crop of large potatoes through that hollow, probably 50 bushels. This alone more than pays for the draining. Then it was so enjoyable to think that we had forced a crop to grow through that old eyesore.

PLANTING.

We put in our entire crop with our old marker, plowing out the furrows and dropping the seed by hand. There is no question but that it paid us. If you could have gone through our field where the stand was not injured by the seed rotting, and seen how perfect it was, and then examined the near-by fields where the planter caused not a few misses, you would agree with me. The saving in seed, and more perfect stand, will much more than pay for the hand-dropping, if you have a faithful and expert man to do it.

Then a neighbor who planted when the soil was rather damp and heavy, using the planter on soil as fertile as ours, failed to get as good returns by half—largely, as he thinks, on account of the packing of the ground by the wedge-shaped marker, or plow, of the planter. We could find this fall, when he dug, the packed furrow-mark made by the planter. Another neighbor, on lighter soil, and crop put in when quite dry, had no such trouble with his planter; but there were the missing hills. I hired an extra man by the day, to help drop, at $1.25, and his dinner and supper. He wanted the job, and dropped about one and a half acres per day of ten hours, and did it nicely.

SMALL SEED.

I think I have told you that we were unable to get large Freeman potatoes enough to plant last spring, and so, from necessity, planted a good many small ones. We cut off the seed end and threw it away, and then split the tubers into two or three pieces, owing to the size. As there are few eyes on the small Freemans, these were about one-eye pieces. Although I would not follow up this practice, we got good results this time. We all thought the potatoes averaged larger than those from large seed that came from friend J. M. Smith, of Wisconsin. This set me to thinking. I knew that small seed would not grow larger potatoes than large, unless there was some other reason. This it was, undoubtedly: The small seed we had kept in our pits during the winter, and it was in absolutetly perfect condition—not an eye having started when it was taken out—while Mr. S.'s seed was slightly sprouted when it got here. Had we kept his seed in our pits over winter, we should have been the gainers.

CHANGE OF SEED.

Our choice seed from Mr. Smith gave no better results than large seed of our own growing, side by side. But now this may be all owing to the fact mentioned above, that our seed was in more perfectly sound condition. Do not think

Mr. S.'s seed was sprouted much. It had started only just a little, probably owing to warm weather while on the way. But for best results I want seed that has not started one single eye. I want the first eye to start in the soil. I have never yet got an uneven stand from planting such seed. They will be slower coming up, of course, and may not be best if you are after very early potatoes.

MANURE VS. CLOVER.

My next neighbor, A. D. Croy, one of our very best farmers, had a field of potatoes right next to one of mine this season. They were early potatoes, the same as mine, and planted the same day. Both fields were originally cleared at the same time, and belonged to one farm. They are very similar in character of soil. Mr. Croy has kept a dairy all these years that the writer has been farming with clover, and has never had heavy crops of clover until recently. Last fall and winter he drew manure on to his field, which was a timothy sod with a little clover in it, giving it a heavy covering. My field had the clover roots and second-crop clover plowed under. Now, the fact that he used a planter would make some difference with the result; but his soil was so dry that about the only injury came from a less perfect stand. Again, I have been growing potatoes for many years in regular rotation on my land, while friend C. has grown only two crops before on his. Now, the result was 549 bushels on a little over four acres of his land that was heavily manured, and 912 bushels on $5\frac{1}{10}$ acres on my clover land. Mr. C. kept his seed in the pit, the same as mine, cut to one eye, and in tillage it would be hard to do any better than he did. There is no use in being modest about it. We just simply "get there" by the use of clover. Yes, 912 bushels this dry year, and with present prices, is good enough.

ARE WE HOLDING OUR OWN?

Let us compare the yields of this dry season with those of 1881, which was almost exactly a similar season with us

Each year we had one soaking rain, and all other showers were too light to do much good, and potatoes gradually yielded to drouth, in spite of all we could do. In 1881 we had 869 bushels of potatoes on 5½ acres, in our best lot, and this year 912 on 5 1/10 acres. In 1881 we had 531 bushels on the clay lot, from a perfect stand. This year we had 520 bushels on about five-sixths of the same lot, one-sixth of the stand being lost from the seed rotting.

TILLAGE.

The tillage on the field next to neighbor Croy's was perfect, so far as we know. I can not look back and see where we could at any time have done any better than we did. No weeds stole either plant-food or moisture from the crop. No water evaporated directly from the soil that we could prevent. We made the spring moisture serve us just as long as possible. Of course, in time it gave out mostly, and potatoes suffered and died in spite of all man could do. We actually stirred the surface of the field between the rows an inch deep after the vines were half dead, and it paid. Every drop of water we could keep from evaporating went to help make tubers.

CULTIVATORS.

I think I mentioned that we should try the Planet Jr. cultivator and harrow with 12 teeth, of which you have a picture in another chapter. We did. It is a grand good little tool for fine surface tillage. With the pulverizer on in the rear I found I could set it so a man could not run the teeth too deep. The wheel in front and pulverizer in the rear held the teeth up so one could easily do perfect work. This is a tool that has come to stay.

FERTILIZER EXPERIMENTS.

You will remember what I have said about how these turned out in previous years. But I felt anxious to try them once more this season. So I bought 1400 lbs. of one of the best brands of potato-fertilizers on the market. I bought

from the manufacturers direct, so I know it was fresh, and the best they make, as they know me and what it was to be used for. One set of experiments was on our very best land; another on our poorest land, mostly clay. In each case we put in four rows with about 500 lbs. of fertilizer per acre; four rows with 1000, and four with 1500. The rows ran through the field. We put in four rows so we could measure the two rows in the middle of each strip, which could not be affected by plants stealing from adjoining plots. All tillage was exactly the same, and seed and planting. When cultivating we were always careful to allow of no variation in time that could affect the result. Well, of course the rows were marked with stakes, and we watched them pretty carefully, as did our neighbors and others. At no time during the season could any one pick out the rows where fertilizers were used, by their larger growth, either on good or poor land—not even where more than $30.00 worth per acre was used. Nor was there any variation at digging-time more than what there will always be, as no two rows are likely to yield exactly the same. In fact, some of the fertilized rows yielded slightly less than the others. We have thrown away our money again. As one neighbor put it, "You have paid about $40.00 to learn what you knew before." Well, not exactly. I did not really *know* but that my soil might now respond to fertilizers; but it will not, on poor land or rich, where we are growing clover. One man says this was owing to the dry season. Very well; it is claimed that fertilizers show effects for several years. We will see if any one can tell in growth of wheat or clover where 1500 pounds per acre of complete fertilizer was put.

SCAB.

To be sure that we did not plant any germs of this disease, all seed was treated with corrosive sublimate, both the good and the doubtful. Friend Smith's seed was perfect; but I knew he had some scab on his place last season, and so we

treated all his seed. As a result, our crop is nice and smooth, almost perfectly so, except a few that grew on an old strawberry patch that had been heavily manured. These are fine and large, but scabby. We will save them to plant, as they can be made safe by soaking in the sublimate solution. We made very much less work of doing this job this year. Our potatoes were quite clean, and we did not wash them. We used the same solution over and over until it was worn out, and believe it was just as well. We shall most certainly treat all seed next year, sound or not. We have the new boxes, that we used last spring, carefully put away where no germs can get on them. In these and new bags we will handle the seed next year after treating.

SPRAYING.

We bought two knapsack sprayers—one Galloway and one Garfield. We could not afford to fuss with one—must get along faster. We bought knapsacks instead of a cart-sprayer to be drawn by a horse, because, first, better work can be done with less material by a man walking, and spraying one row at once. He can go slower when vines are large, and step faster when sprinkling a small plant; in fact, he can spray every hill perfectly. To do this with a cart would require a great waste when vines are small. Again, the damage from turning at the ends with horse and cart, in our small fields, would be too much. We had as good potatoes as the average, clear out to the very ends, this year. Cultivating with one horse, we need do almost no damage at the ends in turning, even with rows coming within four feet of the fence. Of course, in large fields one may leave headlands to turn on, and cultivate with two horses, and spray with a cart and horse. But there is another point in this spraying business: You may use a cart the first two times; but on our farm, in a good season, by the time you want to spray the third time, the vines will so cover the ground that a cart would do much damage by rolling down vines. My

vines touched together between the rows this dry year when we sprayed the third time. If you grow a variety of potatoes that stands up straight, and on poor enough land so they never cover the ground, you may use a cart and get along faster. I would not have let you go through one piece of ours, this year, once, with a cart, for $50. However, the Freeman potatoes spread over the ground more than some. Well, we bought knapsacks to spray with; and, for the reasons given above, and after trial, we are satisfied. It is work to carry them all day; but when we get through we have done our best, and no damage. As to whether spraying with the Bordeaux mixture did us enough good to pay this year, I can hardly say. It was a bad year to test the matter. There was almost no blight weather. The potatoes had an

THE KNAPSACK SPRAYER.

unusually bright, healthy look where sprayed; but there was not blight enough present anywhere to do any damage, practically. We shall try it again most thoroughly. Perhaps I had better tell you briefly how we managed.

Before beginning I went to our experiment station, and Prof. Green kindly told me just what to do. First, I took one head out of a fifty-gallon coal-oil barrel. Then I got two four-gallon crocks. Into one I put 4 lbs. of blue vitriol, and brought from the house two gallons of hot water, and poured on it. Then I put 4 lbs. of unslacked lime (lumps) into the other crock, and poured on water enough to slack it. Then

LOADING UP WITH THE MIXTURE.

I stirred first one and then the other. The vitriol will dissolve quickly in *hot* water. Beforehand I took a common tin pan to the tinshop and had them cut out the bottom and put in a bottom of fine brass strainer cloth, the same as they use for milk-strainers. As soon as the vitriol and lime were dissolved I poured the vitriol into the oil-barrel; then I dipped the whitewash out of the crock (make it thin by using water enough) with a pint tin cup, and poured it through the strainer-pan. It would usually go through quite readily, but sometimes we had to use more water along with it to work it through. It is necessary that this lime water be strained through this very fine wire cloth, or the lime would

clog the nozzle of the sprayer. Next we put in water enough to fill the barrel, and churned it up thoroughly. I say "churned," notice. You can not stir it and mix as quickly. I nailed a block across the end of a pole, making a sort of churn-dasher.

Now for the spraying. I got two old boxes and nailed them together so that, when a man sat down on the smaller one, the knapsack would just rest level on the other, and placed these boxes so the knapsack would be against the barrel. Then I filled it (always after churning a few strokes) with a gallon tin measure. Get a large tin funnel to use with the measure: you can fill much faster. While men were spraying I fixed up more vitriol and lime in the crocks, and drew another barrel of water, so when the first barrel of the mixture was used up I could mix another and not delay the men, always being ready to fill their sprayers when they came around. Our sprayers hold five gallons, and we found this enough to go down and back on 60-rod rows, so we had to fill only at one end of the field. It took us three about a day (10 hours) to spray 6 acres. We could do it faster, but we tried to do thorough work without regard to time. We never used more than 40 gallons of the mixture per acre, and less when vines were small—not very much less, however, as, when vines are small, you waste some between the plants, which, when they grow larger, falls on plants instead of on the ground. The cost of the mixture, in money, was 20 cts. a barrel of 50 gallons, 4 lbs. of vitriol costing 16 cts., and the lime at retail costing one cent a pound. We had to buy this a little at a time to get it fresh and unslacked. We bought a barrel of vitriol, some 350 lbs., so as to get it at wholesale rates, as that will keep. We sprayed about once in two weeks, and Prof. Green advised four or five sprayings. In rainy weather, spraying oftener might be better, and in dry weather you might wait longer. We began when plants were six inches high. It will do little good to begin spraying after blight appears. It is a preventive measure, and you

keep spraying often, so as to coat new leaves as they come out, so as to prevent the blight-seeds, which float around in the air, from taking root on them. You can use Paris green in this Bordeaux mixture to kill the larvæ of the Colorado beetle. We did not, but picked by hand as usual.

OLD-FASHIONED BUGS.

There were many of the old blister-beetles, as we used to call them, this year. We did not have them, but many did. I do not believe they can be poisoned. They may be driven off by whipping and abusing them; but from one experience of my own, and some I have from others, I think that poison used as for the Colorado beetle will drive them off. They will not eat it, and will not die, of course, as you want them to; but if all the vines are thoroughly wet with Paris green and water I think they will not destroy them. They will go to some other patch, perhaps, but I do not know what better we can do, practically, in a large field. They may be caught in one of our bugging-pans, with water in and coal oil on top, or in hot water, by knocking them off the vines into it, the same as we do the larvæ of Colorado beetles, with paddles. This for a small patch. I shouldn't like to try it on a large field.

DIGGING.

I feel as though I had not said enough in favor of the Hoover digger, it was so very valuable to us this year. The ground was almost as dry and hard as stone. It would have cost us a good deal of money to get the crop dug by hand, and made us very late about getting our wheat in. With four horses on, however, the digger went right straight through, and no trouble, and we didn't pay out one cent for digging (except a few cents for a bolt broken), and we took out the potatoes in a hurry too. The last day of August we put 305 bushels into the barn, and the next day 340. Very few potatoes were cut, and practically none of merchantable size left in the ground. With fast work, of course, now and

then one will get missed. Oh, but we took those potatoes out of that hard ground so nicely and easily and cheaply! It was business, I tell you. But still, some would have trouble. The digger must be kept in order, and every nut tight. I ride on it myself, and know every click. I know at once if any thing is wrong, and see to it before damage is done. I have never had any occasion to send for any repairs. The digger is in as perfect order to-day as when we bought it. The bolt broken this year came from my being a little too strong when I tightened a nut. I feel that this simple truth is due the manufacturers for sending out a tool so well made that it will stand, year after year, being drawn by four horses.

PREPARING FOR WHEAT.

We think we have done this a little better this year than ever before, and this is really a part of potato culture, as all large growers will have a rotation, and wheat will usually follow the potatoes—that is, if they are early ones, and rye, perhaps, if they are late ones. There are two particular things we want to do after the potatoes are dug. The digger pulverizes the rows or drills nicely. First, we want to tear up the soil between the rows, as well as the digger does that in the rows. Well, take your Planet Jr. cultivator with five teeth 2½ or 3 inches wide, and go right over the field between the rows after the digger. Weight it with a large stone. How simple! But we never thought of it before. Afterward we used the cutaway crosswise, lapping half, and then we came to a point where we wanted to level the field. This year we tried the common (about here) clod crushers and levelers, and were pleased with the work done. It will pay a grower to make one. Take six 4x4 scantling, say 8 ft. long, and place them side by side, but with corners up and down, not the flat sides, and bore ¾-inch holes through them about 18 inches from each end, running an iron rod through each of these rows of holes. A nut at the back side will hold the scantling together, and a ring at the front end will give

you a place to hitch a draft-chain to. Draw by a forked chain, one end being hitched to each draft-rod. This is a

CLOD CRUSHER AND LEVELER, MADE OF 4x4 SCANTLING.

very simple and cheap leveler. After leveling we harrowed with a Thomas smoothing-harrow, and rolled ready for drilling. As it was very dry still, and while we were waiting for rain, we then worked the land some more, although friend Root was here when we were going over the field with the leveler, and thought it was wonderfully fine and nice then. You notice I am a little careful about working land very much in the spring when it is moist, but I tell you we grind it down fine when it is dry and we are preparing for a crop. We can not overdo the matter then, unless a heavy rain comes right after we put in wheat, and we try not to get caught that way. Our soil would not go through that Bordeaux-mixture sieve, quite, but it would not lack much of it. Now, this is not talk, friends. I do it—have done it for many years. It pays grandly. Be sure to use *wide* teeth on the cultivator. This will stir the soil more—bring new particles in contact more. Now, don't half prepare your potato-stubble for wheat any more. Don't do it because you are in a hurry to get the wheat in. A good point was made in the *Practical Farmer* lately. A friend said that one day's more work in making soil finer would put a crop ahead ten days before winter. Several chapters might be spent on this subject, but it is a little outside of potato culture, so I have given only a few brief pointers.

With very early potatoes the vines will decay so as not to be in the way of preparing for wheat. Of course, you won't have any weeds. For potatoes that ripen later, like the Freeman, we find it best to rake up the vines after digging, and draw them off. Later they are spread on the poorest places in clover field, where potatoes are to be planted the next year. Don't burn them. Some do. I saw some burn-

ing this year—a dead loss—nitrogen all gone back to the air, and potash and phosphoric acid in a heap. Spread the vines thinly, and plow under and save all.

ROTATION AND WEEDS.

When friend Root was here right after we had planted our potatoes, he saw here and there a dock in the field. He asked me about these, and if I had said any thing about them in the book. Now, of course I get as clean clover seed as I can; but we care very little for all such pests, with our short rotation. They do us little damage. If there are docks in the clover, and there will be some years, we cut early enough always to prevent their going to seed. If the second crop was used for hay, we should do the same again. If for seed, or to plow under, we must cut out the docks. The roots plowed under for potatoes will sprout up once or twice, and I take a hoe as soon as the potatoes come up and run over the piece and cut them off as low down in as I can readily, and that ends them. The heavy growth of clover will smother almost any thing except docks—that is, the first year of its growth alone—and the next year, when weeds might work in, we have it turned under and in potatoes. Clean culture of potatoes, and use of mower on wheat-stubble, along with this short rotation, gives one the upper hand of weeds.

FARMING TOO MUCH MIXED.

Now, friends, don't think that you can grow potatoes as I do, in addition to all that you may already be doing. We work so systematically, and have so many tools, and have had so much experience, and have so little else to do, that some things I have said may leave the impression that it is an easy matter to make potatoes pay grandly. I can point you to men this year, as always, pretty good farmers too, who made miserable failures in the potato-field, on account of having too much to do. The potatoes were not cared for all through in the best way and on time. One man can not do every thing; and once more I would urge you to do

thorough work in a few lines rather than half do more things.

Friend Root was telling me the other day about a man who would not buy our strawberry book because Terry wrote part of it, and he didn't believe Terry ever raised so many strawberries on half an acre as he told of, or he would keep on doing it. Well, strawberries pay; potatoes pay; but we found it not best for us to try to make them both pay together. While we were picking and selling $200 or $300 worth of berries, we could easily lose that much in the clover and potato fields by not being right on time with haying and tillage. That is the trouble with much of our mixed farming. I know you will not all own it, friends, but it is the truth all the same. Half-way work does not pay any longer. You undertake more than you can study over, and really do the best you know how. We did so at first. We got a little off the track growing berries to sell. As seasons run, there is the most profit, and freedom from worry, on our farm, in sticking right by the potatoes, wheat, and clover. Sometimes when friend Root is here he says, "Why don't you do this? and why don't you go into raising that?" I am afraid he forgets that it is different with him. He can get any amount of extra help at any time, and, of course, can oversee many things. We farmers usually have to get along with a fixed amount of help the season through; and if we get into a pinch we can not get extra help at any minute, and hence we may lose on one thing what we make on another.

CARE OF POTATOES FOR EATING.

All are interested in this. I have to buy my potatoes to eat this year, as we raised all Freeman, and can not afford to eat them yet. I bought 50 bushels of a neighbor. He brought us one bushel right from the field, when they were digging. They were very white and nice. The next bushel (he hadn't time to bring the whole lot) was quite poor. Many were yellow, and almost green. I spoke to him about it, and he said, frankly, that they left that bushel standing

in a sack in the barn where it was light for some days. Many eat such potatoes all the time. There is no need of it. They are not nearly as good. Keep them in the dark, from the time they are dug until you eat them, after first growing them down in the ground, and see how much nicer they are. We are sorting ours over now for seed. They are exposed to the light, of course, for some time, and would not be suitable for eating.

STORING.

We dug as usual about the first of September, when weather was exceedingly warm, and stored right in the basement of our barn, in a pile some 60 feet long, 11 wide, and 4 deep. We find them in perfect condition. But, of course, we handled them with care, and there were almost no bruised ones. A cut potato may rot in warm weather when stored in a large heap like this.

SECOND GROWTH.

I think nothing has been said about this. You can not always prevent potatoes from making a second growth, and being prongy, when they almost die down during a dry spell, and then rains come and start them to growing again. The tubers have so nearly matured that they refuse to expand farther in a regular way, and, instead, throw out prongs, or little tubers, from the large ones. Careful surface tillage helps some in the way of preventing second growth, by keeping the crop thriving longer than it would if neglected. As long as the potatoes are kept growing right along they are quite safe. A check to their growth causes premature ripening, after which rains may make trouble, if they are not entirely dead. Notice, I say *may* make trouble. The tendency to grow prongs is greater in some varieties—that is, a slight checking of growth brings it on, while other kinds can rarely be induced to play this trick. The long potatoes generally make the most trouble. Oval-shaped tubers rarely throw out prongs. We had Freemans die down almost entirely

last season, and afterward green up and grow for some time. There were *no* prongs. The smaller tubers made use of the new supply of food, and the large ones ripened. There is, as you must have noticed, a greater tendency to grow prongs where the ground is hard, as at the ends of the field where the horses have tramped the soil much in turning. Two or three wrote me this year, asking what they had better do when their potatoes began a second growth and were getting prongy. I advised them to dig and sell at once, if there was a good demand. They were not ripe enough to store safely. If they could not sell them green, why, they must let them grow, although the crop would be very unsatisfactory when badly covered with prongs.

CONCLUSION.

This book was mostly written and put in type early in the summer; but later the publishers decided to wait and get in this chapter with this year's experiences; so you can see why they are given by themselves, instead of in their proper place in the book.

Now, friends, please do not write me, asking questions about this and that. Every thing has been plainly told you somewhere in the book. I would willingly write to you; but there are thousands of you, and only one of me, and I get *so* tired of writing. It looks mean not to answer a friend's letter (to him), even if you are so tired you can not sleep.

PUBLISHER'S APPENDIX.

Some of the Reasons for Plowing as directed in this Book; Going into the Details a little more.

After reading what is said about plowing, on page 13, I wrote to friend Terry in regard to it, and his reply will be found after the following:

Friend Terry:—

It seems to me that some cuts illustrating your manner of plowing would be an excellent thing. I confess I had to read your description over a good many times before I got your idea exactly, and at the same time it is a problem I have been studying on for a good many years, and yet I am not sure I have got it right now. You say, take one of our strips 16x60 rods—do you mean 16 rods wide by 60 long? If so, it seems to me there is a deal of running the plow and team across the end empty—that is, doing no plowing. Perhaps this can not be avoided. But if the above is what you mean, why not make narrower lands? Again, why not commence in the middle, far enough from the end so as to plow across the ends also, and turn every furrow inward? In this way you do not tramp the plowed ground at all; but there is considerable tramping the corners, and a bad awkward dead-furrow when you come to reverse the process, to bring your ground back level. May be you are all right in having your lands 16 rods wide; but I want to be sure about it. A. I. R.

April, 1893.

I enjoy this criticism ever so much; and although the statement is as clear as I can make it, friend Root shall have it all pictured out, and he shall be made "sure" that I am right. I just like the chance to show that I know what I am about, or to try to. But first let me say two or three things. One is, that, if I should follow out every little point to the very end, in a way that I now propose to go over this one, this book, instead of being a little pamphlet

that any one can afford to buy and find time to read, would have several hundred large pages in it. Again, in my writing and institute work, the aim has been, not to tell a man every thing, but, rather, to rouse him up, set him to thinking on the right track, so far as I know, but leave a little something for him to work out, even though I might tell him myself. Men take more stock in something they help work out. True education consists in drawing out and leading out the student, not in stuffing him with what *you* know. Well do I remember, when, about 16 years old, going to my teacher (Milo Clapp, now of Warren, O.), with a hard problem that I was working over. He had given us some general hints in the class how to go to work at it, and left us to fight it out for ourselves. Friend Clapp looked at me very kindly and said something like this:

"Now, Theodore, I can easily show you; but that won't do you any good. I would conquer that matter myself, unaided, if I were you."

Well, I did, sitting up most of the night when our folks thought me in bed. That doing for myself that night was worth hundreds of dollars to me. Now, I think we are all students as long as we live, or should be. I am studying now on farm problems as never before. I get help and suggestions from others; but many things I do and must dig out for myself. Friend Bonham lately wrote me exactly the same thing in regard to his management of our Ohio institutes, that it was his aim to help the farmers just enough to lead and encourage them to help themselves. Friend Root is a busy man, and has no time to study out matters; but still he did, you see, and now he will remember and think about it ten times as much as if it had been all made plain. Probably by this time he has thought out what I shall say now. Why, I have many times studied to make statements that would provoke men into studying and figuring to try to show I was wrong. What we want is more thinking and studying over our business. Now see,

friend Root, what you have "drawn me out" to tell, and for the first time too, I think.

Now for the figures: The first represents a field we plowed this spring. Yes, friend Root, it is 16 *rods* by 60 rods. It is 16 rods wide. We plowed it as usual, in one land. This

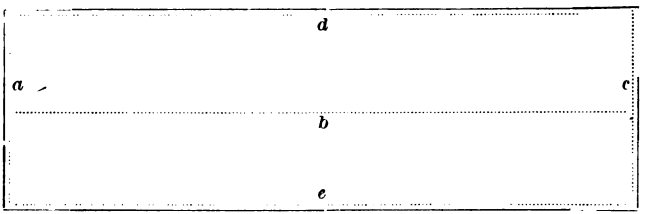


FIG. 1 —FIELD 16x60 RODS, AND HOW TO PLOW IT.

year it was back-furrowed. The dotted line *b* shows the center of the field. The short dotted lines *a* and *c* are about 10 feet from the ends of the field. These spaces between the dotted lines *a* and *c*. and the ends of the field, were left as head-lands to draw the plow across on. First we put up a line of stakes through, two feet to the left of *b*. We use a right-hand plow. The stakes are set to one side a little, to drive by the first time through, so the first furrow will be laid over to *b*. Beginning at the dotted line *a*, I plow straight through the field to *c*, then turn around to the right and start in on line *c*, and go back to dotted line *a*, putting the furrow just against the first, not up on top of it. Thus I go on around the field until I have plowed to the dotted lines *d* and *e*. Then there is a space of ten feet all around the field, on all four sides, to be plowed, and I plow inward all around them and finish the piece. Practically the plowed land is not trodden on at all. A perfect job has been done. When going across the ends "empty" I take the left plow-handle in my right hand, catch up the reins from the plow-handle, where they usually hang, in my left hand, and slide across the end in a hurry, holding the plow so it will

just run on the side of the share, and make but little mark. The horses soon learn, when I plow, to spin across the ends. It takes a little skill and gumption to lose hardly a second at the corners, in turning the plow out and setting it in.

Now, in three years we will plow this field again. If we plowed the same way we should be piling up a ridge in the center, and making great deep furrows around the outside, which is about as objectionable as throwing all the earth out, year after year, making banks around the fences and a depression in the center, and at lines from the corners to the dead-furrow. Many fields are so treated. It is wrong. The land should be kept level. To do this and not tramp the ground, which is equally important, or more so, not tramp

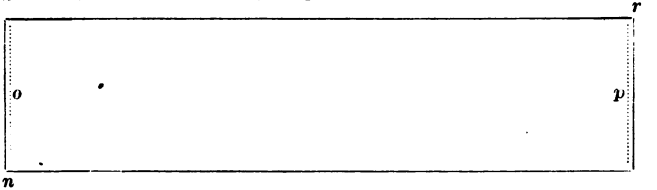


FIG. 2.—PLOWING SAME FIELD THREE YEARS LATER, SO AS TO KEEP GROUND LEVEL.

it any more than we did this year, we begin plowing (Fig. 2) at *n*, setting the plow in on dotted line *o*, ten feet from the end of the field, driving the off horse in the furrow left from three years before, until the plow reaches the dotted line *p*, ten feet from the other end. Then we slide across on the ten-foot head-land, "empty;" set in ten feet from the end at *r;* fill the furrow that side to the dotted line *o;* run empty across the head-land, and so on until the field is done except the head-lands. We are careful to finish so the dead-furrow is exactly where the ridge was made three years before. How hard it is to get a man with gumption enough to do this exactly! Then after harrowing we take our scraper potato-coverer, pictured in chapter 6; attach a board in a few minutes so as to make it like a road-grader (now friend

Root will get stuck again!), and by running around the dead-furrow two or three times with this, we throw in earth enough to practically fill the furrow, and have the whole field for a crop as three years before. But now the head-lands:

We plow these all one way (drawing the plow back "empty," in the furrow), and, of course, throwing earth out toward the ends of the fields, filling the furrow as at the sides. There is a very little tramping at the corners, of course, but not enough to be mentioned, if head-lands are plowed when rather dry. Practically we have this field in as good, untramped condition as it was three years before when back-furrowed. I have been able to study out no better way to get level fields, with no waste or unproductive places, and no injurious tramping.

Friend Root's plan of back-furrowing, so as to plow all the time and not run across the ends empty, is pretty good; but when plowing sod deeply you will have some piled-up ridges from the four corners in, where you turn, much more troublesome than the one straight ridge I have across each end at the dotted lines *a* and *c*, and far worse-looking. And then in no way can you get that land back level the next time without great pains at the corners, and very serious tramping. If stubble, you can plow up these corners that you have tramped down, after the field is plowed, and help matters some; but with sod you can not do this.

Let us now figure on these points a little. Of course, I did this years ago, and changes have been made as a matter of business, as well as looks. Friend Root says there is a deal of running across the ends with plow and team without doing any work, and why not make narrower lands? In plowing the lot represented by Fig. 1, as it was plowed this year, the average distance that we went light on each end was 8 rods, or 16 rods at each round. We aim to plow but a foot wide. We could turn wider furrows, but do not wish to, as, at a foot wide, it pulverizes the soil more perfectly.

There would be 264 furrows in the field, or 132 rounds; 16 rods of going light per round on the average, for 132 rounds, makes 2112 rods in all. This, divided by 320, the number in a mile, gives something over 6½ miles. If plowing myself, and pushing things as I have most of my life, I would do this 6½ miles sliding at the ends in two hours' time. But say my man is more easy, and takes three hours. That is slow enough. I count the time of the man and team at $3.00 per day, or 30 cents per hour. The going light at ends, then, as we managed this year, cost 90 cents.

Right here let me stop to consider another point. Plowing is about the first hard work in the spring. The horses are not used to it, and ought not to be worked too steadily at first. If plowing all the time, and not going light on the ends, I certainly would stop and let the horses rest a minute or two quite often. We are very careful of our horses. As it is, they get a rest, comparatively, when sliding across the ends, even quite fast, so they are ready for another 60-rod pull. I take it this will cut down on that 90 cents considerably; but, say nothing about it. See if we can not balance the 90 cents with cash.

Now, friend Root, we will suppose the same field plowed in two lands, to save some of the time that we go empty. The average distance that we would go light in this case would be just half what it was when the field was plowed in one land; so in the end we should have wasted (?) in this case but 45 cents' worth of time instead of 90; but 45 cents is worth saving, friend Root, as sure as can be. But suppose it costs you in another way several times 45 cents—what then?

With the two lands in the field, of course there would be a dead furrow in the center of the field from end to end, practically; and with our plowing, from eight to nine inches deep, such as we did this year in that lot, it would be a huge dead-furrow too. This would be very apt to wash out and cut down, on our rolling land, in some places, so a horse

would not cross it. But never mind that. And then how it would look, that great bare ditch through the middle, when friend Root went by on his wheel and tried his Kodak on the field! But let that go; we are after actual dollars. There will be at least one full row less of potatoes. They won't grow in a dead-furrow as well as water will run in it; 16 rows make an acre, and $6.00 a row would not be a large return. Between you and me, if we have a good season I rather hope for $10.00. We had some last year, poor as it was, that did better than this, sold for market price, 75 cents a bushel. But just call it $6.00 a row. It costs about $2.00 a row to plant, furnish seed, care for and harvest the crop. This gives us $4.00 net for that row in the place of the ugly dead-furrow, to say nothing of the wheat that will grow there. Now how is it? With your fields drained, so narrow lands and furrows are not necessary to carry off water, is it or is it not business to spend 45 cents' worth of time to get back $4.00 in net returns? Can you make any such profit on your manufacturing business, friend Root? Why, it is almost the German's 10 per cent—buy for $1.00 and sell for $10.00. I did intend to put the figures on to the tramping of corners with the old way of plowing, where potatoes are to be grown; but I think perhaps friend Root will take that on trust now, rather than to have me write some ten pages more.

PUBLISHER'S APPENDIX.

BY A. I. ROOT.

Potato Culture in General.

Perhaps I should say to our readers that I am not a professional potato-grower. In fact, the most I have done in potato culture for many years has been to raise extra early potatoes for the early market; and to do this I have used only the earliest varieties, and have started the potatoes in a greenhouse. As we have found that, for extra early potatoes, there is quite an advantage in using large whole potatoes, we have practiced this almost entirely of late years. We plant them in the greenhouse about as close as we can place the potatoes together, and then cover them with very rich sifted soil for about two inches. When the shoots get to be from four to six inches high, we take them up as you take up cabbage-plants; but in this case the great mass of fibrous roots hold a great quantity of soil with them. In fact, we manage to take along pretty much all of the soil above the potatoes, besides considerable below them. I should have said, we generally start our potatoes under the greenhouse benches, or in some place where there is not sun enough for other crops. Of course, we have to calculate so that it would be safe to move them outside before they get too long and spindling. After all danger of frost is past they are put out in very rich ground about the ordinary distance of planting. Of course, the frost sometimes catches them; but where the ground is very soft and mellow it is not very expensive to throw a light furrow of soft earth over them, and pull it away again as soon as the danger is over. A better way, however, is to put them in plant-beds 12 or 15 inches apart each way, and have these beds covered with cotton sheeting that may be rolled up on a pole, as we described in the

tomato book. In this way it is but little work to protect them from frost and cold winds; and the ground on such small areas can be made exactly right for potatoes; and as they require great quantities of water where grown so closely, it is an easy matter to arrange for irrigating. I confess I have not succeeded as well as I should like to in getting extra early potatoes by this method, but I am still at work at it. I know it can be made to succeed, because I have had tremendous yields of beautiful potatoes that came up of themselves in my plant beds among the other plants. I frequently let such volunteer sprouts grow just for the fun of it; and as the potato-plant is quite sensitive, it serves somewhat as a guide for protecting other plants. If we manage so that the potato-shoots are uninjured, the rest of the stuff is not likely to take any harm. One drawback to this matter of raising early potatoes is, however, the exceedingly nice potatoes that come from the South about the time these are ready that are started under glass and cloth. We usually get 40 or 50 cents a peck for the forced early potatoes; and sometimes, when the market happens to be short, we have got as high as 60 cents. Of course, we are prepared to dig them at any stage whenever we can get an offer that we think will pay us for the trouble.

POTATO CULTURE FOR MARKET-GARDENERS.

Aside from raising potatoes for the early market, market-gardeners can often put in a crop of potatoes where something else has been removed. In fact, we have had excellent potatoes where strawberries have been turned under just after the last picking; but, of course, it is a little risky in planting so late. Besides, the ground used by market-gardeners is very apt to become in time permeated with the pores of the scab, in consequence of the large quantities of stable manure used. By turning under some crop like strawberries, or even clover, and then treating the seed with corrosive sublimate, I think we could manage to avoid the

scab. Of late we have had less scabby potatoes with the late varieties; and we have just harvested a crop of Rural New-Yorkers where one-third of an acre gave us 116 bushels. These were planted some time in June, where we turned under a piece of rye. The rye was so heavy that we found difficulty in getting it all under the soil. It was on creek-bottom land, somewhat sandy and gravelly, but had been quite heavily manured before the rye was turned under. There were almost no scabby potatoes in this lot, and yet the seed was not treated at all; neither were there any bugs to bother us, of any account, except the old-fashioned ones that friend Terry has already mentioned.

OLD-FASHIONED POTATO-BUGS.

These have been so bad in our locality that, in several places, the farmers have turned sheep into the field and driven them back and forth to scare off the bugs. While this plan might be better than to let the bugs destroy them entirely, I don't believe I should want sheep running through my potatoes. We kept the bugs off from our Rural New-Yorkers by scaring them off on to the ground between the rows, and then stamping them and killing them with our hoes. This might seem slow work; but if you undertake it you will find in a very little time not a bug will be found in the patch. Keep careful watch; and if you find them on the vines again next morning, route them out in the same way. Simply driving them off with whips or bushes does not seem to answer as well. When they begin to discover that you mean death to the bitter end, they conclude it is time to be going elsewhere. Sometimes where these bugs are quite plentiful, if you drive them off from your potatoes they will collect on the fence or on bushes, like a swarm of bees. If you can get them to do this you are lucky. With a bundle of shavings, burning straw, or something of the sort, on the end of a pole, just burn up the whole swarm before they can have time to disband.

STORING POTATOES WHERE IT IS LIGHT; GETTING RID OF DAMPNESS, ETC.

In the fall of 1886, I, too, had a small patch of potatoes raised on the Terry plan. They were on a piece of low creek-bottom land; in fact, it was a piece of ground that had been considered so low and wet as to be good for nothing. By underdraining, however, I had got rid of the dampness entirely, and the potatoes were the second crop that had been raised on the piece. Every thing worked beautifully, and even friend Terry himself pronounced the crop a fine one when he looked at it while it was growing. Now, I have raised potatoes more or less all my life, but I confess I had never seen any thing like what Terry describes in this book. I had never seen any such yields per acre, nor any thing like digging potatoes at the rate he mentions. When they were dug, however, I sent a good man with a wagon-load of bushel boxes, and a boy to pick up the potatoes. I came up behind them during the forenoon, and was astonished at the way they were throwing them out and filling the boxes. I thought they were making pretty good progress, so I glanced at my watch, and, to my astonishment, a good plump bushel was thrown out and picked up in just six minutes. The man's wages is 15 cents per hour, and the boy's 5 cents. So you can see it cost me just 2 cents per bushel to dig the potatoes and put them in the boxes. I do not know what the cultivation cost, but the ground is so mellow it didn't cost very much. Now, there are other places on our land where the man and boy could hardly get a whole bushel in half an hour. Do you not see the point? Poor ground can be made, by proper care, to do as well as the best, and you have to go through almost the same motions that you do with the good ground.

There is something more, however, to tell about these potatoes. We had had, the year before, trouble with our potatoes rotting, and I found those at the top of the barrels, at the sides, and even at the bottom, were sound, and free

from rot, while those in the middle spoiled badly. It occurred to me that it was for lack of being thoroughly dried out before they were put away, and for want of ventilation in the cellar. Just at that time a writer in one of the agricultural papers said if potatoes were stored for a while in a loose loft in a barn, they would never rot. Accordingly my fine crop of potatoes was placed overhead in the toolhouse, and left there longer than they should have been. I had forgotten, or never realized thoroughly, what friend Terry says about keeping potatoes in the dark. I believe, however, I shall remember that chapter the rest of my life. My large nice potatoes, under the influence of even the small amount of light there was in the tool-house, had turned green—sometimes half way to the center. Now, my wife is very particular about her potatoes, and almost every day she tells me how much trouble it is to prepare these for food. and how much has to be thrown away, until I have decided that hereafter our potatoes shall be stored in the blackest of midnight darkness, from the minute they are dug until they are ready to use. When questioned at the institute, Mr. Terry said that potatoes should be stored in a cellar absolutely dark, and that they should be put on a floor of loose boards, with plenty of openings between the boards, several inches from the cellar bottom. Furthermore, if the quantity was large, square wooden ventilators were to be set up every few feet through the pile. These ventilators communicate with the air between the loose floor and the cellar bottom. This, you see, permits the air to move freely among the potatoes while they are kept in absolute darkness. At the same time, the cellar is to be kept as cold as possible, by opening the doors and windows nights and mornings, and closing them during the middle of the day. If managed properly, the disagreeable operation of rubbing off sprouts may be almost entirely avoided. Keep down the temperature, and keep away the light.

Another thing I wish to notice right here about potatoes

for table use. My wife says, by all means get a variety without deep eyes that have to be dug out and thus consume the valuable time of the good woman of the house.

During the session of the institute, friend Terry devoted one whole evening to his most excellent essay, entitled "Wife Culture." He spoke particularly to the men in regard to making our homes convenient and pleasant, and especially in lessening the labors of the "queen of our homes." This latter expression was originated, I believe, by our good friend Prof. Cook, of the Michigan Agricultural College.

A word more in regard to the care of potatoes in the cellar. Friend Terry mentioned that he once drew a load of potatoes to a college professor; and this professor was one of the kind who think that, because a man is a professor in some special branch, he knows all about every thing else. This man had his own ideas in regard to storing potatoes, and so he directed friend Terry to put them on the bottom of the cellar, right on the ground, and spread them out "one deep," while the light of day shown in freely from several windows. Friend Terry remonstrated, but the professor would not listen. Of course, he never bought another potato of friend Terry. I presume he is ready to testify that Terry's system doesn't produce good potatoes. Friend T. said he supposed he had been all his life trying to find somebody who could raise potatoes that would *stay good*. No doubt he grows sadder as he grows older and meditates on the degeneration of farmers, and especially potato-growers.

If we want to raise nice potatoes, we must plant nice ones. The same rules that we all know work so surely in regard to saving the seed of tomatoes seem to work with potatoes. If you want nice potatoes for the queen of your home, you must select nice round smooth ones for seed. Whatsoever a man soweth, that shall he also—*dig*.

I think it will not be out of place to mention here, that, if you are interested in this book, and would like to know any

thing more about friend Terry's system of farming, you will find his other books noted and described on the cover a pleasant sequel to this one.

UNDERTAKING TO CARRY ON A GREAT MANY ENTERPRISES ALL AT ONCE.

In several places in this book, friend Terry has earnestly cautioned against this sort of thing. In fact, it is well known that Terry advocates specialty farming, selecting one branch, or perhaps, rather, one line of work, and doing that well. I believe he also refers to myself as a man who is able to carry on a good many kinds of business, having always plenty of help that can be called on in an emergency. This is true; but notwithstanding I am satisfied that Terry is right. I have had, perhaps, as much experience as almost any other one man in keeping a great number of industries going all at one and the same time. I have all my life, however, found that this is true: The kind of business that I give most of my personal attention and supervision to always pays best; and where I trust entirely, or almost entirely, to hired help, the result is often loss instead of gain. Some people do carry on two or even three farms at once. I have never tried it, and I am sure I could not do it. I find by experience that it is very hard for me to make any enterprise pay unless I can look over the work, say every forenoon and every afternoon; and where several men are working together, I very much prefer to look in upon them every hour. Where a man has a good-sized family, say of grown-up sons who want something to do, the whole family can frequently manage so as look after different enterprises with profit. If the father grows potatoes, the sons can grow strawberries, take care of bees, or any similar line; and even the grown-up daughters often manage bees and strawberries, and such other industries, very nicely. In fact, friend Terry has told us how his daughters grew strawberries, and made money at it. When selling the berries, however, the father's help seems to have been a very necessary part in making the business pay.

OTHER USES FOR POTATO-BOXES.

Not only do we use these for storing all kinds of roots, potatoes, apples, etc., but while I am writing, Nov. 22, our hands have been packing our celery as fast as it is dug, right into the potato-boxes. We lay the boxes on one end, then take up the celery with a little earth adhering, and pack it tight and close in a box, till the box is full. After being filled, the boxes are turned over right side up. The celery can now be loaded into a wagon or other vehicle without extra handling, and without breaking and mashing the tops; and it is but a short job to lift it out and set the boxes tight up together in a dark cool cellar or other repository. If the cellar seems to be too dry, and inclined to wilt, the whole floor of it may be flooded with water, letting it go through the bottom so as to dampen the roots, but without wetting the tops in the least. So far as I know, this is the first time celery was ever handled in this way. But please notice: While we were loading it up near the roadside, a man stopped his team and wanted to know why he could not take one of those boxes right along, put it into his cellar, and use the celery as they wanted it. I assured him it was exactly in the shape he wanted it for that purpose. Selecting one of the best boxes, when he found he could get box and all for a dollar he handed over the money, and the box-ful of celery was in his wagon in a minute. You will notice this fixes it in nice shape to retail, so that people in the country or anywhere else can use it all along through the winter, just as they want it.

PLANTING POTATOES VERY LATE, ETC.

During the past season I have been greatly interested in watching the operations of a young farmer in Terry's neighborhood, who works on somewhat of a modification of Terry's system; that is, he has a rotation of his own that does not include wheat after potatoes. I can best tell you about it by making some extracts from some notes I published in our journal at different times during the summer.

VISIT TO WILBUR FENN'S, NO. 1.

At Tallmadge I called on my relative, Mr. Wilbur Fenn. He was out plowing a piece of ground just 100 rods long; and the minute I looked down the furrow he had just turned, I uttered an exclamation of surprise and delight. Do you know why? This hundred-rod furrow was about as straight as you could draw a string. It was of even, regular depth its whole length, and the fine soft loam rolled over exactly the same way from one end of the furrow to the other. In fact, the field was almost ready to plant just as the plow left it. My cousin, young Fenn's father, explained to me that one reason why his son did so nice a job just then, was that he was teaching his hired man to plow straight. Some of you may say that a crooked furrow would give just as good a crop as a straight one. Well, I suppose it might under some circumstances; but look here, my friend. The man who plows a straight furrow like that does every thing else accordingly, in making his preparations for a crop. The ground will be so well fitted, and the planting so accurate, that a good hill of corn will grow on every foot of the soil, where there is room for a hill. There will not be too many stalks in a hill nor too few; and there will not be any good *spots* in the field, and poor spots.

Young Fenn is in Terry's neighborhood, and he has caught on to the ideas of good farming that have been so vehemently taught. Let me tell you something about how hard he has worked to get his ground so he could plow such a furrow. First, all the trees and stumps were disposed of; then the rocks and stones. Why, this same ground has been farmed for perhaps fifty years; and when young Fenn got hold of it he commenced getting out every stump and stone that would make the plow dodge. In one place, after digging out a stone that broke his plow-point, he found *six* old broken plow-points in the same spot. His predecessors had broken their plow-points one after another, and contented themselves with putting in a new one and going ahead and leaving the cause to do the same thing again, year after year. Of course, the ground is underdrained; but even then I could not comprehend how that soil should turn over so beautifully soft and even and fine; but he explained it by saying that the field was fitted for oats when that sixty-hour rain came; but the water settled it down so solid and compact that he decided he would not undertake to get

the crop under in such conditions. Therefore he plowed it all over, and was going to put it in corn.*

Just as I was stepping into the buggy to leave, our young friend said we must hold on just long enough to see his potatoes in the cellar. Although it was the last week in May, he had not yet planted them, and did not propose to plant them for some little time. His forte is late potatoes, and he does not undertake to put in wheat after them, as friend Terry does. In fact, he has a rotation of his own fashion, suiting his own needs. The cellar was closed up as tight as a bandbox. Not a bit of air nor light could get in. A hundred bushels of potatoes which he had selected and saved for planting were piled up in the cellar; and so cool was it kept that scarcely a sprout had begun to show, even though it was in May. He raises principally the Monroe Seedling; and every time I go past his place late in the fall I enjoy looking at the bright clean green foliage that is sure to be seen in his potato field just before frost. Somebody told me that he had last season about 1400 bushels, for which he received over $1400. You may say he was lucky in having a big crop when there was a general scarcity; but I tell you it was more *hard thinking* and *prompt acting* at just the right time than it was luck.

VISIT NO. 2, AUGUST 5.

About June 1 I saw the potatoes that he intended to plant spread out in his cool cellar with scarcely a sprout on them; and in this present visit, Aug. 5, we had just been having a nice rain, and I supposed he would be out among them. On inquiry I learned that such was the case. A bright little girl and a couple of boys volunteered to take me down to the field where their papa was at work. As we passed through the garden I began to make exclamations of surprise to see it looking so well during our severe drouth. The children, I found, knew all about it. They could tell me just where the Snyder blackberries were, the Agawam, and all the other varieties. My youngest brother, who was just

* You see, the point is that an expert farmer will not undertake to produce a crop unless he has the conditions something near what he thinks they ought to be. I have frequently had ground fitted ready to plant, just as he did; but I went ahead and put in the seed, thinking I could not very well help the matter. Of course, this field 100 rods long was doing things on a little larger scale, and it would be rather expensive business to go ahead when there is a strong probability of failure over so large a piece.

then paying me a visit from his far-away home in Tempe, Arizona, declared something as follows:

"Why, brother Ame, I believe I am more interested in looking at the blackberries than I shall be with the potatoes. Perhaps you had better go on, and leave me here for a little while."

I accordingly did so. Of course, I enjoyed the blackberries (in two ways); but when I got to where I could see around the rank growth of canes, I did indeed enjoy a glimpse of that potato-field. The hundred bushels of seed had been spread over about nine acres, and it was a great deal like friend Terry's clover. There were no bad spots, and very few extra good spots. The foliage was rank and green, and the cultivators were just stirring the soft fine soil in a way that ought to make any one who loves farming feel happy. There were a few weeds scattered here and there; but my friend said the cultivators would destroy the greater part of them. Said I:

"Why, look here, Wilbur, where are the bugs? What have you done to get rid of them?"

"I haven't done any thing."

"But haven't you had any bugs at all? has your potato-patch looked just like this all through this season, when everybody else has been having such a terrible time with the old-fashioned kind and the new-fashioned kind too?"

"No, we did not have any; and, what is more, I did not expect to have any."

May be you think this pretty cool, dear reader; but I tell you, a farmer who has studied into the matter, and has become acquainted with nature and nature's laws, can often predict a successful crop in just this way. I did not have time to get at the full particulars; but I think his success in evading bugs is, first, by planting late; then by having soil and every thing else in such shape that he can get such a rank growth that the bugs do not relish them or make much headway in their work of destruction. He has visited friend Terry, and they have compared notes, and talked matters over. Now, a great truth comes in right here, and one which, I am sure, friend Terry will fully indorse. It is this: Mr. Fenn, as he is situated, and as he has been working, does not deem it best to follow Terry exactly. In the first place, he does not put in wheat after his potatoes; therefore he plants them late—just as late as he can and avoid frost; and so with other things. But a visit to friend Terry's stimulates him to more energy and harder study in the line he is

working on, even if it be a little different from that of Terry's. That we may learn to think and act for ourselves, is, if I am right, what Terry is trying to teach. His potatoes are planted on clover sod; but there is a heavy growth of timothy mixed in with the clover. He plants with a machine. He said he agreed with friend Terry about hand-planting, and would prefer it; but as he is situated, it is hardly possible for him to take time to plant by hand. As we went over the field, we found, as Terry has said, here and there a hill entirely missing. Sometimes two hills pretty close together were missing. These misses amount to more than I had supposed until friend Terry called attention to it. Mr. Fenn cuts to one eye, or pretty nearly, as Terry does. I asked him if there were no remedy for these missing hills when planting by machinery. He said he knew of none. Of course, there will be less of them if you set the machine so as to put two pieces in occasionally instead of one; but when you reach the proper limit, the remedy is as bad as the disease, or even worse. Now, I am inclined to think the men who make the planters will in some way get around this objection. I suggested putting something else in to fill up these empty places; but in that case you have two crops on the same piece of ground, and the fuss and bother would be more than the crop would be worth. Another thing, the value of the land has a bearing upon the question of missing hills.

Before we left, I wanted to see the crop on that ground where that straight plowing was done. It seemed almost incredible that there should be a good stand of corn where he was plowing so recently as June 1. But there it was. I tell you, friends, there is not a more encouraging sight in this world than an enthusiastic and successful young farmer; and one secret of the success I have mentioned was the bright intelligent young wife who shows by her looks that she is in full sympathy, and knows all about the work that is going on outdoors as well as in the house. Yes, and this is all true, even if she did have a fine healthy-looking baby in her arms, that was no part of the household during that other visit, June 1.

VISIT NO. 3, NOV. 6.

I found cousin Wilbur just where I wanted to see him. He was out in that nine-acre field of Monroe Seedling potatoes. Four horses were moving the Hoover digger, one man driving, with a boy following to wait on the driver, throw

potatoes out of the way that might be covered when they came back, and, if I recollect, six men were picking the potatoes up. I expected something of those potatoes that had not seen a bug or a bit of blight; and as they are on upland, and rather sandy soil, they had kept right on growing almost into November. The yield was about 200 bushels per acre, of the finest-looking potatoes I ever saw spread out in the field. I was astonished to find almost all of them of a nice table size—very few small ones, and almost no prongy potatoes, or those with a little potato growing out at one side. I suppose the variety and his method of management had much to do with it. The ground was just loamy enough so the potatoes tumbled out bright and clean and handsome. I fell in love with them at once. Now, here is a point that I want you to observe: When I came into the field every thing was going on like clockwork, and those potatoes were being deposited in his nice cellar in almost a steady stream; but, of course, I had to stop and ask questions. Pretty soon the team stopped, and could not go on unless the "boss of the ranch" gave directions. Perhaps I might as well tell you that I got to bantering him for a carload of potatoes, and, of course, he could not very well neglect a chance to sell a carload, even before they were taken into the cellar. But there were several details to be arranged about shipping, furnishing boxes to put them in, etc.; and in a very few minutes the whole gang of workmen came to a standstill. The moral is, be careful how you bother a man when he is bossing a job that requires half a dozen or more expert helpers. I told him it was too bad, and so I made my visit quite a hurried one.

One thing that threw him out occasionally, was, they did not have quite enough potato-boxes. I told you six men were picking up potatoes. As fast as they get a load the team comes around and the potatoes are set on the wagon, and taken directly to the cellar. You can do this with a crop of potatoes that are just ready to dig by the first of November. The air is cool then, the potatoes are cool, and friend Fenn assures me that he piles them right into the cellar, even four feet deep. Under such circumstances he carries them through till the following May, or even up into June, with scarcely a sprout and not a particle of wilting.

Before I started for home we looked into the cellar, and saw how he unloaded. An inclined plane made of strips of wood runs from the wagon clear down to the bottom of the cellar. The bushel boxes are set on this inclined plane, on a

sort of carrier. The man with the wagon lets this down with a rope. Another one in the cellar bottom pours them on to the pile. The boxes are pulled up with the same arrangement, and, without any lifting or lugging, the load is disposed of very quickly.

Farming doesn't pay! Doesn't it, though? Friend Fenn is getting more for the potatoes that grew on this land than the land itself would sell for. What do you think of that—paying for a farm with the proceeds from a single season? and a regular farm crop at that! You may ask about the expense of growing this crop. Well, it was not very expensive. The only manure was clover and timothy—that is, if I am correct; and the cultivation was all done by horse power, the driver riding on the cultivator. The potatoes were also planted and dug by horse power. I do not know what he values his farm at; but I do know that, within less than a mile of his home, there is land that can be bought for $40.00 an acre—may be less than that; and what he is doing is on a farm that was called, only a few years ago, a poor run-down farm, and not of very much account.

P. S.—Since writing the above I learn he has taken, from the nine acres, 1910 bushels.

POTATO-BOXES FOR PURCHASERS OF POTATOES.

I have mentioned in the previous pages of purchasing a carload of Monroe Seedlings, just as they lay on the ground. The farm where they were grown is about 25 to 30 miles from our place. Four hundred and fifty empty potato-boxes were stored in the car, which was then sent to the nearest station to the grower. Although in the latter part of November, the grower loaded the boxes on to his wagon, took them to his cellar, filled them, and set them back on the wagon, then made a trip to the car, bringing another load of boxes. On Wednesday, the 22d of November, the Weather Bureau notified us by telegram that a cold wave and a blizzard would reach us by Thursday night. The notice was given us about 36 hours ahead. The railroad companies were notified that several hundred dollars were at stake; and the managers of our own railroad, the Pittsburg, Akron & Western, were considerate enough to hold the train half an hour

so they could get the potatoes through and enable us to save them from the frost. The car was planted on our side-track at just 5 o'clock. We had notice of its coming, and eight of our men and boys were invited to go into the lunch-room and have a good supper, so that they might be ready to handle the potatoes before Jack Frost could nip them. The thermometer showed only 15 degrees above zero, and there was a brisk west wind. The boys, however, handled the potatoes so quickly that, within two hours, the whole carload was safely deposited in the cellar, and the doors and windows closed. You may be sure I drew a long breath of relief when the last box went away. I guess the boys drew some long breaths too. It was worth something to see the way those boxes full of potatoes moved into the place assigned them. Now, here is a little to the credit of our Weather Bureau. They have been criticised during our recent drouth because rains did not always come when they told us conditions were favorable; but as to the matter of temperature they made hardly a mistake; and I am glad to be able to say, also, that at least one railroad company in the United States was willing to hold a train half an hour for the sake of saving a carload of potatoes.

Suppose these potatoes had been picked up or shoveled up, poured into the car, picked up or shoveled up again, and poured into our cellar. Think of the bruising and injury, aside from the convenience and neatness in doing the work. Another thing, as a great part of these potatoes are to be sold at retail, many customers will pay 15 cents extra for the privilege of taking the nice new clean bushel boxes home with their potatoes, for almost every family will find these boxes, that hold an exact bushel when level full, exceedingly handy to have in the cellar, barn, or other out-buildings.

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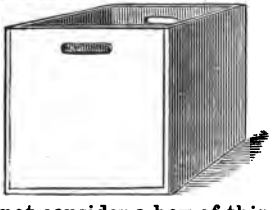
Descriptive Price List of Bushel Boxes.

For the benefit of those who are interested in bushel boxes, and wish to know what they cost, and where to get them, we reprint the following from our bushel-box circular:

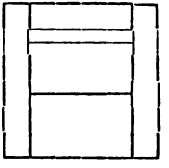
When the first edition of the A B C of Potato Culture was published a few years ago, we had calls for these boxes, and accordingly arranged to furnish them; and, later, there was a demand for cheaper ones; and as they came into more general use it was discovered that they were equally good for handling onions, cucumbers, tomatoes, melons, etc., and we have sold many of them for handling all these crops. We make one style so low in price that, for many things, it could be used as a gift crate for sending produce to a distant market. In the following pages we describe the three styles we keep in stock and are prepared to furnish promptly. If there are other sizes or styles that you find you can use to better advantage we shall be pleased to receive specifications, naming the quantity you can use, and we will make estimates. As these boxes go at fourth-class rate of freight, the charges are reasonable, even to distant points, ranging from 1 to 3 cents per box, depending on the distance.

You notice the dimensions given by Terry in chapter 14 are 13x13x16 inches, inside measure. We make them ¼ inch wider and ¼ inch shallower—i. e., 12¼ deep, 13¼ wide, and 16 inches long, practically the same dimensions, but changed just enough so that, when you handle them empty, one box can be placed inside of two others. Thus they occupy only two-thirds the space, and can be handled in bundles of three at a time instead of singly. Some do not consider a box of this size so easy to lift and carry as one made four to six inches longer, and proportionately narrower and shallower; but we consider that the advantages in favor of this size more than overbalance this slight disadvantage, if it may be called one. Two of these, end to end, just fit crosswise of an ordinary wagon-box that is not less than 34 inches wide.

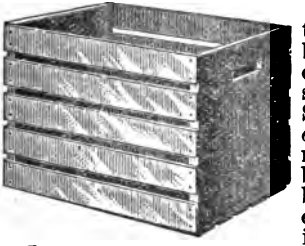


The material used in the boxes is basswood, which is the lightest for the same strength of any thing. It is also tough, and holds nails well, and will not split in nailing. If, in nailing, you soak the ends of the slats or boards, the nails will drive much easier, and will absolutely prevent splitting.

The boxes used by Mr. Terry are made close, with no ventilation; they are also bound with iron, for strength and durability. As we now make them, the ends are of three pieces, ⅛ inch thick, with a cleat ¼x2 inches across each end; the two lower pieces, 5 inches wide, are set close together; leave a ½-inch space for a hand-hole, and a 2-inch piece on top. The cleats across the ends up and down are placed inside the box when nailing on the sides and bottom. This gives one inch surface to nail the sides to; reduces the weight of the box, and makes it stronger. The sides and bottoms are each in two pieces, 6½ wide, and strong, ⅝ thick. The upper edge of the sides on the bound boxes are iron bound with roofing-tin folded thus, and slipped on with the edges in appropriate grooves. When the boxes are nailed up, a piece of galvanized iron ½ inch wide is passed around each end, leaving six or eight inches above the hand-hole uncovered, so there may be no danger of cutting the hands in lifting or carrying the boxes. This binding on the top edge and around the ends adds just 5 cents to the cost of each box, but is well worth it, because of the increased durability. These boxes are packed for shipment in crates of 1 doz, 10 in the flat packed inside of two nailed up, and nails are included for the ten. Each package weighs about 85 lbs., and the price is $2.10—much less, you notice, than Mr. Terry paid for the first lot he had made. Shipped in this way they go as 4th-class freight, while if shipped all nailed up they go at 1st-class—more than double the 4th-class rate. Price of above boxes, all nailed, in lots of 10 or more, will be 22 cents each.

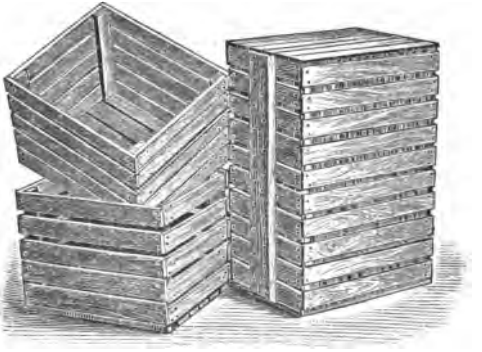


Slatted Bushel Boxes.



In these we use the same ends that we do in the above solid boxes, but the sides and bottoms consist of slats ⅝x2, five on each side and six on the bottom. Since adopting the following *all-slatted boxes* we do not sell many of this pattern. Slatted boxes are not usually iron-bound, because they would be quite liable to catch where the iron crosses the crack between the slats. These boxes are also packed 12 in a crate, 10 in the flat being packed inside of two nailed up, and nails included for the 10; a crate weighs about 80 lbs. Price $1.50. These boxes furnished, all nailed up, in lots of 10 or more, at 18 cents each.

All-Slatted Boxes.



This is the cheapest box we make, and the one we now sell the most of. The ends are made in the same way as above, except that we use six slats instead of boards crosswise, thus making them open on the ends as well as the sides. These are used for tomatoes, apples, cucumbers, etc. In fact, there is nothing of about the size of these, and larger, that could not be handled in these crates. They are as cheap to

ship garden stuff to market in as the ordinary barrels and crates, besides being much lighter and neater. The above cut shows the manner in which all the boxes are packed for shipment. These all-slatted boxes are put up 15 in a package, 13 in flat being packed inside of two nailed up, and nails for the 13 included. A package weighs 90 lbs., and the price is $1.50, or at the rate of 10 cents per box. These boxes, furnished all nailed up, in lots of 10 or more, at 15 cents each.

Condensed Price List.

		Weight.
Solid bushel box, galvanized bound, per crate of 12 - - - - - - -	$2 10	85 lbs.
Slatted bushel box, per crate of 12 -	1 50	80 lbs.
All-slatted bushel box, per crate of 15 -	1 50	90 lbs.
Galvanized binding alone, per crate of 12, - - - - - - - - -	60	

In lots of 10 crates, any one or assorted kinds, 5 per cent discount.

If there are any other styles of crates or boxes that you use and prefer we are prepared to quote prices on application. Please give accurate specifications and quantity wanted. As a rule, the larger the quantity the better the price. We can make special prices on above in large lots ot 50 crates or more, also to dealers who wish to handle them.

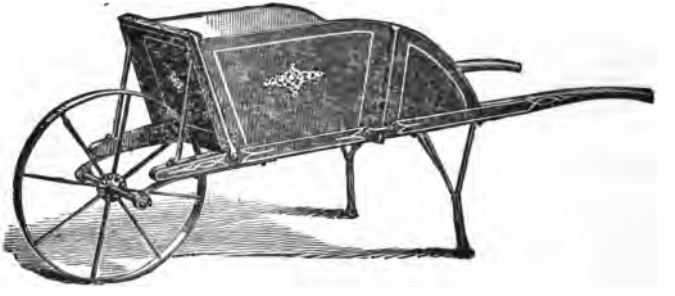
Covers.

Mr. Terry mentions covers as being often convenient. We have never furnished many of these, but are prepared to do so, if any want them, at $5.00 per hundred for plain boards 15x18 inches, without cleats, or cleated at $6.00 per 100. Send orders and inquiries to

A. I. ROOT, Medina, Ohio.

OUR DAISY

Wheelbarrow



There are very few farms or gardens where the work can not be greatly lightened by the use of a wheelbarrow. This is especially true if you can get one sufficiently strong and yet light enough so as not to be a burden in itself. You will look a long time before you find one that will meet your needs better than the Daisy shown above. This weighs only 35 to 40 lbs., and yet it is warranted to carry 500 lbs. safely. It has oil-tempered springs, so as to avoid the jar on the arms. The wheels and legs are of steel; the wheels now furnished have round spokes set zigzag. The whole is handsomely painted, striped, and varnished, so that it is truly a "daisy." It pleases so well that we have, during the past few years, sold over 1000 of them, and have had three carloads in all made especially for us, and so low that we are able to offer them for a less price than you usually have to pay ror a clumsy article not nearly so handsome, light, and strong. The sideboards are removable. The dashboard is attached with two bolts and two braces. It is shipped with legs and braces wired to the wheel, and sides and dash crated to the handles and bottom. We furnish two sizes—the larger one, No. 2, being about two inches wider and a little deeper than No. 3, the smaller. Price of No. 3 is $4.00; of No. 2, $4.25. In club orders of three or more, we will furnish three of the No. 3 for $10.00, or three of No. 2 for $10.50.

A. I. ROOT, Medina, Ohio.

A B C OF

STRAWBERRY CULTURE.

FOR FARMERS, VILLAGE PEOPLE, AND SMALL GROWERS.

A BOOK FOR BEGINNERS.

BY T. B. TERRY.

The above book, by Terry, with some additional remarks by A. I. Root, is, at the present time, creating an enthusiasm and interest in strawberry culture never known before. It is a book of 144 pages and 52 engravings, and is fully up to the times.

PRICE 35 CTS.; BY MAIL, 40 CTS.
PUBLISHED BY A. I. ROOT, - - MEDINA, OHIO.

GLEANINGS IN BEE CULTURE,

A 36-Page Semi-Monthly.

$1.00 Per Year.

Each issue is printed on the finest of book paper with the best book ink, handsomely illustrated with a large variety of original engravings. Sample copy free.

THE MANUFACTURE OF

BEE-KEEPERS' SUPPLIES

IS OUR SPECIALTY.

A 52-page catalogue of every thing pertaining to bee culture will be sent for your name on a postal.

A. I. ROOT, - - - MEDINA, OHIO.

THE WINTER CARE OF

HORSES and CATTLE;

The Most Humane and

Profitable Treatment.

By T. B. Terry.

Although the book is mainly in regard to the winter care of horses and cattle, it touches on almost every thing connected with successful farming.

Shelter, Comfort, Feeding, Exercise, Kindness, Different Sorts of Seed, and a full Treatise on the Most Economical Way of Saving Manure.

A full description of Terry's model barn is also given.

PRICE 35 CENTS; BY MAIL, 40 CTS.

MAPLE SUGAR AND THE SUGAR-BUSH.

BY PROF. A. J. COOK,

AUTHOR OF THE

Bee-keepers' Guide, Injurious Insects of Michigan, &c.

The name of the author is enough of itself to recommend any book to almost any people; but this one on Maple Sugar is written in Prof. Cook's happiest style. It is

PROFUSELY ILLUSTRATED,

And all the difficult points in regard to making the very best quality of maple syrup and maple sugar are very fully explained. All recent inventions in apparatus, and methods of making this delicious product of the farm, are fully explained.

PRICE 35 CTS.; BY MAIL, 40 CTS.

PUBLISHED BY A. I. ROOT, MEDINA, OHIO.

Tile Drainage,

OR

Why, Where, When, and How to Drain Land with Tiles.

A PRACTICAL BOOK FOR PRACTICAL FARMERS.

BY W. I. CHAMBERLAIN, A. M., LL. D.

Formerly Secretary of the Ohio State Board of Agriculture, and late President of the Iowa State Agricultural College. At present Associate Editor of the Ohio Farmer.

"Tiles are political economists. They are so many young Americans, announcing a better era and a day of fat things."—Ralph Waldo Emerson.

This is a valuable companion to our other rural books. It embraces the experience of forty years of one of our foremost practical agriculturists, who has laid with his own hands over 15 miles of tile. The book is fully illustrated.

PRICE 35 CTS.; BY MAIL, 40 CTS.

A. I. ROOT, - - - MEDINA, OHIO.

Tomato Culture.

IN THREE PARTS.

Part First.—By J. W. Day, of Crystal Springs, Miss., treats of Tomato Culture in the South, with Some Remarks by A. I. Root, Adapting it to the North.

Part Second.—By D. Cummins, of Conneaut, O., treats of Tomato Culture Especially for Canning-Factories.

Part Third.—By A. I. Root, treats of Plant-Growing for Market, and High-Pressure Gardening in General.

This little book is interesting because it is one of the first rural books to come from our friends in the South. It tells of a great industry that has been steadily growing for some years past; namely, tomato-growing in the South, to supply the Northern markets. The little book, which is fully illustrated, gives us some pleasant glimpses of the possibilities and probabilities of the future of Southern agriculture. Even though you do not grow tomatoes to any considerable extent, you will find the book brimful of suggestions of short cuts in agriculture and horticulture, and especially in the line of market-gardening.

PRICE 35 CTS.; BY MAIL, 40 CTS.

A. I. ROOT, - - - MEDINA, OHIO.

THE A B C OF BEE CULTURE.

By A. I Root.

A Cyclopedia of Every Thing Pertaining to the Care of the Honey-Bee.

This is a cyclopedia of 400 pages, and is beautifully illustrated by over 300 engravings, many of them full page. Some of the latter embrace a view of the apiaries of some of our largest and most successful bee-men. The whole work is elegantly bound in cloth, 7 inches wide by 10¼ inches long, and embossed on side and back in gold. It would be an ornament on the center-table of any bee-keeper's home.

Since the first issue in 1877 its average sale has been over 200 copies per month, and the sale has been steadily increasing from the first. Prices: Neatly and s rongly bound in cloth, by mail, $1.25; by express or freight with other goods, $1.10.

Merrybanks and His Neighbor.

By A. I. Root. This is the title of a little book of 210 pages and 68 illustrations. It narrates the alternate failure and success of a beginner who ultimately, through much tribulation, becomes a successful bee-man and a power for good in Onionville. Appropriate original cuts, many of them humorous, are interspersed here and there, representing some of the droll experiences which a beginner with bees sometimes passes through. Besides bees, it talks of other rural pursuits, such as gardening, maple-sugar making, etc. It has a good deal to say about our homes, and more particularly one home which was started upon a sandy foundation, but eventually became builded upon the Rock Jesus Christ. The book is full of instruction; price 25 cents; 3 cents extra when sent by mail.

What to Do, and How to be Happy While Doing It.

The above book, by A. I. Root, is a compilation of papers published in GLEANINGS IN BEE CULTURE in 1886, '7, and '8. It is intended to solve the problem of finding occupation for those scattered over our land, out of employment. The suggestions are principally about finding employment around your own homes. The book is mainly upon market-gardening, fruit culture, poultry-raising, etc. I think the book will be well worth the price, not only to those out of employment, but to any one who loves home and rural industries. Price in paper covers, 50 cts.; cloth, 75 cts. If wanted by mail, add 8 and 10 cts. respectively.

A. I. ROOT, MEDINA, OHIO.

Books by T. B. Terry and Others.

The long winter evenings bring extra time for reading. A part of this time could not be more profitably spent than in reading the following rural hand-books which we send by mail at the uniform price of 40c each.

The A B C of Potato Culture. Paper, 220 pages, 4x5, illustrated. This is T. B. Terry's first and most masterly work. The book has had a large sale, and has been reprinted in foreign languages. The second edition, reset and almost entirely rewritten, is just issued. When we are thoroughly conversant with friend Terry's system of raising potatoes, we shall be ready to handle almost any farm crop successfully. Price 40c, postpaid.

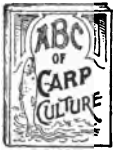
The A B C of Strawberry Culture. Paper, 150 pages, fully illustrated. This is Terry's latest *small* book, and has received some very high words of praise. Who among rural people does not have a little garden-patch? If you would learn to raise in it that most luscious of all fruit, the strawberry, with the best results, you can not be without this little book. Even if you don't grow strawberries you will be the better for reading it.

Tile Drainage. By W. I. Chamberlain. This is a valuable companion to our other rural books. It embraces the experience of forty years of one of our foremost practical agriculturists, who has laid with his own hands over 15 miles of tile. Paper, 150 pages, illustrated. Price 40c, postpaid.

Winter Care of Horses and Cattle. This is friend Terry's second book in regard to farm matters; but it is so intimately connected with his potato book that it reads almost like a sequel to it. If you have only a horse or a cow, I think it will pay you to invest in the book. It has 44 pages, 7x10, illustrated. Price 40c, postpaid.

Maple Sugar and the Sugar-Bush. By A. J. Cook. Paper, 44 pages, 7x10, illustrated. This is most valuable to all who are interested in the product of our sugar maples.. No one who makes maple sugar or syrup should be without it. If you don't make maple syrup you may want to know how it is made, and how to judge of a good article when you buy it. Price 40c, postpaid.

Tomato Culture. In three parts. By J. W. Day, D. Cummins, and A. I. Root. Paper, 150 pages, illustrated. A most valuable treatise embracing field culture, forcing under glass, and raising plants for market. Valuable to any one raising garden stuff of any kind, aside from tomatoes. Price 40c, postpaid.



A B C of Carp Culture. In paper covers, illustrated. This is a work of 70 pages, 7x10, written by Geo. Finley and A. I. Root, and the best authority on the subject of carp culture yet in print. The rearing of carp is a pleasant and profitable amusement. This book will tell you all about it. Price 40c.

Terry's First Large-Sized Book.

We have just received 100 copies of "Our Farming," from Wm. Henry Maule. Price, by mail, postpaid, $2.00. If ordered by express or freight with other goods, you may deduct the postage, 15c.; or we will send the book by mail, postpaid, with GLEANINGS, for $2.50.

A. I. ROOT, Medina, Ohio.

Books for Bee-Keepers and others.

Any of these books on which postage is not given will be forwarded by mail, postpaid, on receipt of price.

In buying books, as every thing else, we are liable to disappointment if we make a purchase without seeing the article. Admitting that the bookseller could read all the books he offers, as he has them for sale, it were hardly to be expected he would be the one to mention all the faults, as well as good things about a book. I very much desire that those who favor me with their patronage shall not be disappointed, and therefore I am going to try to prevent it by mentioning all the faults, so far as I can, that the purchaser may know what he is getting. In the following list, books that I approve I have marked with a *; those I especially approve, **; those that are not up to times, †; books that contain but little matter for the price, large type, and much space between the lines, ‡; foreign, §. The bee-books are all good.

BIBLES, HYMN-BOOKS, AND OTHER GOOD BOOKS.

As many of the bee-books are sent with other goods by freight or express, incurring no postage, we give prices separately. You will notice, that you can judge of the size of the books very well by the amount required for postage on each.

8 | Bible, *good print*, neatly bound..... 20
10 | Bunyan's Pilgrim's Progress**..... 30

20 | Illustrated Pilgrim's Progress**..... 75
This is a large book of 425 pages and 175 illustrations, and would usually be called a $2.00 book. A splendid book to present to children. Sold in gilt edge for 25c more.

6 | First Steps for Little Feet. By the author of the Story of the Bible. **A better book for young children can not be found in the whole round of literature, and at the same time there can hardly be found a more attractive book. Beautifully bound, and fully illustrated. Price 50 c. Two copies will be sold for 75 cents. Postage six cents each.**

5 | Harmony of the Gospels..... 35
3 | John Ploughman's Talks and Pictures, by Rev. C. H. Spurgeon*..... 10
1 | Gospel Hymns, consolidated Nos. 1, 2, 3, and 4, words only, cloth, 10 c; paper..... 05
2 | Same, board covers..... 20
5 | Same, words and music, small type, board covers..... 45
10 | Same, words and music, board covers..... 75
3 | New Testament in pretty flexible covers... 05
5 | New Testament, new version, paper covers. 10

5 | Robinson Crusoe, paper cover..... 10

4 | Stepping Heavenward**..... 18
15 | Story of the Bible**..... 1 00
A large book of 700 pages, and 274 illustrations. Will be read by almost every child.

5 | The Christian's Secret of a Happy Life**.... 25
8 | Same in cloth binding..... 50

| "The Life of Trust," by Geo. Muller**..... 1 25
1 | Ten Nights in a Bar-Room, T. S. Arthur*.. 05

5 | Tobacco Manual**..... 45
This is a nice book that will be sure to be read, if left around where the boys get hold of it, and any boy that reads it will be pretty safe from the tobacco habit.

BOOKS ESPECIALLY FOR BEE-KEEPERS.

Postage.]		[Price without postage.
15	A B C of Bee Culture. Cloth	1 10
5	A Year Among the Bees, by C. C. Miller	45
	Advanced Bee Culture, by W. Z. Hutchinson	50
3	Amateur Bee-keeper, by J. W. Rouse	22
14	Bees and Bee-keeping, by Frank Cheshire, England, Vol. I.§	2 36
21	Same, Vol. II.§ r	2 79
	or, $5.25 for the two, postpaid.	
	Bees and Honey, by T. G. Newman	1 00
10	Cook's New Manual. Cloth	90
5	Doolittle on Queen-Rearing	95
2	Dzierzon Theory	10
1	Foul Brood; Its Management and Cure; D. A. Jones	09
1	Honey as Food and Medicine	05
10	Langstroth on the Hive and Honey-Bee‡	1 25
15	Langstroth Revised by Ch. Dadant & Son	1 25
10	Quinby's New Bee-Keeping	1 40
	Thirty Years Among the Bees, by H. Alley	50
4	Success in Bee Culture, by James Heddon	46
	Handling Bees, by Langstroth. Revised by Dadant	08
	Bee-keeping for Profit, by Dr. G. L. Tinker	25
5	The Honey Bee, by Thos. William Cowan	95
	British Bee-Keeper's Guide Book, by Thos. William Cowan, England§	40
3	Merrybanks and His Neighbor, by A. I. Root	15
4	Winter Problem in Bee-keeping, by Pierce	46

MISCELLANEOUS HAND-BOOKS.

5	A B C of Carp Culture, by Geo. Finley	35
5	A B C of Strawberry Culture, by T. B. Terry and A. I. Root, 144 pages; 32 illustrations	35
5	An Egg-Farm, Stoddard**	45
	Amateur Photographer's Hand-book**	70
	Barn Plans and Out-Buildings*	1 50
	Canary Birds. Paper	50
	Draining for Profit and Health, Warring	1 50
10	Fuller's Grape Culturist**	1 40
	Farming For Boys*	75

This is one of Joseph Harris' happiest productions, and it seems to me that it ought to make farm-life fascinating to any boy who has any sort of taste for gardening.

7	Farm, Gardening, and Seed-Growing**	90

This is by Francis Brill, the veteran seed-grower, and is the only book on gardening that I am aware of that tells how market-gardeners and seed-growers raise and harvest their own seeds. It has 166 pages.

12	Gardening for Pleasure, Henderson*	1 85

While "Gardening for Profit" is written with a view of making gardening PAY, it touches a good deal on the pleasure part; and "Gardening for Pleasure" takes up this matter of beautifying your homes and improving your grounds without the special point in view of making money out of it. I think most of you will need this if you get "Gardening for Profit." This work has 404 pages and 203 illustrations.

12 | **Gardening for Profit, new edition****..... 1 35
This is a late revision of Peter Henderson's celebrated work. Nothing that has ever before been put in print has done so much toward making market gardening a science and a fascinating industry. Peter Henderson stands at the head, without question, although we have many other books on these rural employments. If you can get but one book, let it be the above. It has 376 pages and 138 cuts.

| **Gardening for Young and Old, Harris****.... 1 25
This is Joseph Harris' best and happiest effort. Although it goes over the same ground occupied by Peter Henderson, it particularly emphasizes thorough cultivation of the soil in preparing your ground; and this matter of adapting it to young people as well as old is brought out in a most happy vein. If your children have any sort of fancy for gardening it will pay you to make them a present of this book. It has 187 pages and 46 engravings.

10 | **Garden and Farm Topics, Henderson****.... 75
| **Gray's School and Field Book of Botany**... 1 80
5 | **Gregory on Cabbages; paper***..... 25
5 | **Gregory on Squashes; paper***..... 25
5 | **Gregory on Onions; paper***..... 25
The above three books, by our friend Gregory, are all valuable. The book on squashes especially is good reading for almost anybody, whether they raise squashes or not. It strikes at the very foundation of success in almost any kind of business.

15 | **How to Make the Garden Pay.****..... 1 35
By T. Greiner. This is a new book, just out, and it gives the most explicit and full directions for gardening under glass of any book in the world. Those who are interested in hot-beds, cold-frames, cold-greenhouses, hot-houses or glass structures of any kind for the growth of plants, can not afford to be without the book.

| **Handbook for Lumbermen**..... 10
10 | **Household Conveniences**..... 1 40
2 | **How to Propagate and Grow Fruit, Green*** 15
2 | **Injurious Insects, Cook**..... 25
10 | **Irrigation for the Farm, Garden, and Orchard, Stewart***..... 1 40
This book, so far as I am informed, is almost the only work on this matter that is attracting so much interest, especially recently. Using water from springs, brooks, or windmills, to take the place of rain, during our great droughts, is the great problem before us at the present day. The book has 274 pages and 142 cuts.

3 | **Maple Sugar and the Sugar-bush****..... 35
By Prof. A. J. Cook. This was written in the spring of 1887 at my request. As the author has, perhaps, one of the finest sugar-camps in the United States, as well as being an enthusiastic lover of all farm industries, he is better fitted, perhaps, to handle the subject than any other man. The book is written in Prof. Cook's happy style, combining wholesome moral lessons with the latest and best method of managing to get the finest syrup and maple sugar, with the least possible expenditure of cash and labor. Everybody who makes sugar or molasses wants the sugar-book. It has 42 pages and 35 cuts.

1 | **Poultry for Pleasure and Profit****..... 10
11 | **Practical Floriculture, Henderson*** 1 35
10 | **Profits in Poultry***..... 90
2 | **Practical Turkey-raising** 10
By Fanny Field. This is a 25-cent book which we offer for 10 cts.; postage, 2 cts.

4 | **Peabody's Webster's Dictionary**..... 10
Over 30,000 words and 250 illustrations.

2 | Rats: How to Rid Farms and Buildings of them, as well as other Pests of like Character 15

This little book ought to be worth dollars instead of the few cents it costs to any one who has ever been troubled with these pests, and who has not? It is written in such a happy vein that every member of the family will read it clear through, just about as soon as they get hold of it. It contains a complete summing up of the best information the world can furnish.

1 | Silk and the Silkworm..... 10
10 | Small-Fruit Culturist, Fuller..... ..... 1 40
10 | Success in Market-Gardening*... 90

This is a new book by a real, live, enterprising, successful market-gardener who lives in Arlington, a suburb of Boston, Mass. Friend Rawson has been one of the foremost to make irrigation a practical success, and he now irrigates his grounds by means of a windmill and steam-engine whenever a drought threatens to injure the crops. The book has 208 pages, and is nicely illustrated with 110 engravings.

| Ten Acres Enough.... ... . 1 00
| The Silo and Ensilage, by Prof. Cook, new edition, fully illustrated 25
| Talks on Manures*..... ..... 1 75

This book, by Joseph Harris is, perhaps, the most comprehensive one we have on the subject, and the whole matter is considered by an able writer. It contains 366 pages.

2 | The Carpenter's Steel Square and its Uses. 15
10 | The New Agriculture; or, the Waters Led Captive..... 75
2 | Treatise on the Horse and his Diseases..... 10
5 | Tile Drainage, by W. I. Chamberlain..... 35

Just out. Fully illustrated, containing every thing of importance clear up to the present date.

The single chapter on digging ditches, with the illustrations given by Prof. Chamberlain, should alone make the book worth what it costs, to every one who has occasion to lay ten rods or more of tile. There is as much science in digging as in doing almost any thing else; and by following the plan directed in this book, one man will often do as much as two men without this knowledge. The book embraces every thing connected with the subject, and was written by the author while he was engaged in the work of digging the ditches and laying the tiles HIMSELF, for he has laid literally miles of tile on his own farm in Hudson, O.

5 | Tomato Culture..... 35

In three parts. Part first—by J. W. Day, of Crystal Springs, Miss., treats of tomato culture in the South, with some remarks by A. I Root, adapting it to the North. Part second—By D Cummins, of Conneaut, O., treats of tomato culture especially for canning-factories. Part third—By A. I. Root, treats of plant-growing for market, and high-pressure gardening in general. This little book is interesting because it is one of the first rural books to come from our friends in the South. It tells of a great industry that has been steadily growing for some years past; namely, tomato-growing in the South to supply the Northern markets. The little book, which is fully illustrated, gives us some pleasant glimpses of the possibilities and probabilities of the future of Southern agriculture. Even though you do not grow tomatoes to any considerable extent, you will find the book brimful of suggestions of short cuts in agriculture and horticulture, and especially in the line of market-gardening.

8 | What to Do and How to be Happy While Doing It, by A. I. Root..... 50

2 | The New Celery Culture 15

This summing-up of this new industry amounts to this: You fix your ground just as rich as you can possibly get it, with stable manure, chemical fertilizers, or any thing else that will do the business. Then put out your plants 7 inches apart each way, and give them water enough to make them boom right along from the word go. The idea is somewhat new; but enough succeeded in 1892 to demonstrate that, like the new onion culture, it promises great possibilities.

3 | Winter Care of Horses and Cattle..... ... 35

This is friend Terry's second book in regard to farm matters; but it is so intimately connected with his potato-book that it reads almost like a sequel to it. If you have only a horse or a cow, I think it will pay you to invest in the book. It has 44 pages and 4 cuts.

3 | Wood's Common Objects of the Microscope**..... 47

NEW BOOKS ON GARDENING.

2 | Celery for Profit, by T. Greiner..... 25

The first really full and complete book on celery culture, at a moderate price, that we have had. It is full of pictures, and the whole thing is made so plain that a schoolboy ought to be able to grow paying crops at once, without any assistance except from the book.

3 | Onions for Profit 45

Fully up to the times, and includes both the old onion culture and the new method. The book is fully illustrated, and written with all the enthusiasm and interest that characterize its author, T. Greiner. Even if one is not particularly interested in the business, almost any person who picks up Greiner's books will like to read them through.

5 | Manures; How to Make and How to Use them; in paper covers..... 45

6 | The same in cloth covers..... 65

Covering the whole matter, and discussing every thing to be found on the farm, refuse from factories, mineral fertilizers from mines, etc. It is a complete summing-up of the whole matter. It is written by F. W. Sempers.

7 | Market-gardening and Farm Notes, by Burnett Landreth 90

The Landreths are the pioneer seedsmen of America; and the book is worth fully as much as we might expect it to be. I think I received hints from it worth the price, before it had been in my hands fifteen minutes. It is exceedingly practical, and tells what has been done and what is BEING done, more than it discourses on theory.

A. I. ROOT, Medina, Ohio.